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SHIRAKI (T.). **Catalogue of injurious Insects in Japan (exclusive of Animal Parasites). Volumes I–VII.**—*Prelim. Stud. econ. sci. Sect. nat. Resources Div. G.H.Q. Allied Powers* no. 71 ; 47, 128, 162, 167, 126, 82 & 130 pp., multigraph. Tokyo, 1952.

A systematic list is given of over 3,000 insects that are injurious in Japan, showing their popular names in English and Japanese, their distribution and the plants, products, etc., attacked. Indexes to the scientific, English and Japanese names of the insects and to the materials attacked are appended.

PLATE (H. P.) & FRÖMMING (E.). **Die tierischen Schädlinge unserer Gewächshauspflanzen, ihre Lebensweise und Bekämpfung.** [The Animal Pests of our Glasshouse Plants, their Bionomics and Control.]—8½×6 ins., 288 pp., 126 figs., 18½ pp. refs. Berlin, Duncker & Humblot, 1953. Price *DM.* 19.60.

The greater part of this book on pests in glasshouses in Germany is devoted to arthropods, mostly insects and mites. The sections on the pests are arranged systematically, and notes varying in scope and degree of detail are given on the numerous species dealt with, usually including information on the plants attacked or other injurious activities and sometimes on bionomics and distribution. The final section, which deals with control, contains notes on natural enemies, mechanical measures, and chemical pest control. Special attention is given to the use of modern contact insecticides, and a list of proprietary materials available in Germany showing their uses is included, with recommendations for the control of specific pests.

OUTIN (G.). **Le pou de San José (*Quadraspidiotus perniciosus* Comst.) en Allemagne occidentale.**—*Rev. Path. vég.* **29** fasc. 1–2 pp. 10–16, 1 map, 1 ref. Paris, 1950.

The author describes the discovery and distribution of *Quadraspidiotus perniciosus* (Comst.) on fruit trees and bushes in western Germany, gives a map showing the extent of the various infested areas [*cf. R.A.E.*, A **38** 224, etc.] and outlines the plan of control instituted against it in 1948. This involves winter treatment of all nurseries in the French and United States zones with white oil, DNC or emulsifiable anthracene oils ; one or two summer treatments of all infested nurseries with white oil or parathion ; and fumigation of all nursery stock with hydrocyanic acid gas. Also, all fruit trees in infested areas and in a protective zone round each of them are treated with DNC, white oil alone or with DNC, or a tar distillate in winter and with white oil or parathion in summer. This programme has given complete control in several small areas and reduced the severity of the infestation in the main one.

GASSER (R.) & WIESMANN (R.). **Contribution à l'étude écologique et à la destruction du hanneton (*Melolontha melolontha* L.). Observations et essais effectués à Sarrebourg en 1949.**—*Rev. Path. vég.* **29** fasc. 1–2 pp. 43–101, 16 figs., 36 refs. Paris, 1950. (With a Summary in English.)

Experiments on the prevention of infestation by larvae of *Melolontha melolontha* (L.) by insecticidal treatment of trees at the edges of woodland to kill the feeding adults before they oviposit were carried out in Switzerland in 1948, when a DDT dust proved toxic but not sufficiently persistent to effect complete control [*cf. R.A.E.*, A **39** 358], and near Sarrebourg, in Alsace, in 1949, when a DDT spray was applied from an aeroplane. The area concerned in the latter year and the aeroplane and spraying equipment are described.

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The spray was an emulsion of the water-in-oil type containing 15 per cent. DDT. It was prepared by diluting a stock emulsion (Gesarol 9255) to 75 per cent. The woods consisted mainly of beech with some oak and a few other trees.

Examination in late April 1949 of soil samples from fields bordering the woods showed that pupae and adults were present, usually within 8 ins. of the surface, at rates of about 3·7–8·2 per sq. yard. Adults emerged from the soil during daytime at mean temperatures of not less than 10–12°C. [50–53·6°F.] and flew to the woods at dusk, provided that the temperature was at least 10°C. If it was lower, they made the flight during the following day or on a later evening when the required temperature was reached. Counts made between 21st April and 12th May showed that two-thirds of the emerging adults were females, and it appeared that males tend to emerge earlier than females. Flights of newly-emerged adults to the edges of the woods occurred from 14th April until 23rd May, and 90 per cent. of the females were unfertilised when they reached the trees. The leaves, particularly those of beech, were not fully developed until early May. The beetles fed mainly on oak and beech, little on wild cherry and not at all on ash. Very few were found on hedges, which consisted mainly of sloe and hawthorn. Flights from the woods to the fields for oviposition began on 20th April, reached a maximum on 3rd–5th May and continued until the second half of May. They occurred only at dusk until the end of April, after which some took place during the day. Evening flights began progressively later as the days lengthened.

Examination of the state of the ovaries of the females and of the foliage [*cf.* **40** 188] indicated that treatment should have been applied on 30th April. Owing to unfavourable weather, it was postponed until 3rd–4th May, when over 40 per cent. of the females had reached sexual maturity, and a strip 38·5 yards deep along the edge of the woods was sprayed instead of the 11-yard strip that would have sufficed earlier [*cf.* **41** 43]. The spray was applied at a rate giving 3·51 lb. DDT per acre and adhered well to the foliage. Beetles began to drop from the trees soon after treatment, and the treated area was practically freed from them in 2–3 days. The numbers collected on the ground averaged 65·3 and 0·21 per sq. yard on treated and untreated areas, respectively. Beetles that reached the treated areas later were also destroyed, and it is estimated that the deposits remained toxic for 150 days. Examination of soil samples from the fields indicated that treatment reduced the numbers of larvae by 84 per cent., as compared with control areas, in spite of the lateness of the application. With the exception of Diptera, other forest insects were relatively little affected, and no losses were recorded among honey bees, which seemed to work mainly in the open fields. Laboratory tests showed that the deposits were highly toxic to bees while still wet, but much less so after they had dried.

GYÖRFI (J.). **Die Schlupfwespen und der Unterwuchs des Waldes.** [Hymenopterous Parasites and Forest Undergrowth.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 32–47, 29 refs. Berlin, 1951.

Many Hymenopterous parasites have principal and subsidiary or alternative hosts. The latter play an important part in bridging the gaps that occur when the generations of the parasite and the main host do not coincide and in maintaining the parasite when the principal host becomes scarce. Insect pests that are important on several kinds of forest trees in Hungary are taken as examples, and lists are given of their parasites and of the subsidiary hosts of these and the plants on which they feed. Many adult parasites feed on nectar and congregate where certain weeds flower. It is shown that a considerable proportion of the plants concerned form part of the undergrowth of natural

forests, and the author considers that enriching the flora in plantations promotes biological control and prevents mass outbreaks of pests more effectively than planting mixed stands without undergrowth [*cf. R.A.E.*, A **36** 353].

GÖSSWALD (K.). **Anlage einer Station zur Massenzucht von Königinnen der Kleinen Roten Waldameise.** [The Establishment of a Station for Mass Rearing of Queens of the Small Red Forest Ant.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 77–104, 13 figs., 28 refs. Berlin, 1951.

The small form [*minor*] of the red forest ant [*Formica rufa rufo-pratensis* Forel] [*R.A.E.*, A **35** 212] gives valuable control of some forest pests in Germany. The author describes the progressive growth under suitable protection in 1947–50 of 64 nests of the so-called spruce race of this form founded artificially during these years in a spruce stand near Würzburg, and of a natural colony of four nests existing there. The aim was to found a station with 100 nests, each containing about 500,000 workers, for the mass rearing of queens for artificial propagation of the species.

SCHMUTTERER (H.). **Zur Lebensweise der Nadelholz-Diaspidinen (Homoptera, Coccoïdea, Diaspididae, Diaspidinae) und ihrer Parasiten in den Nadelwäldern Frankens.** [Contribution to the Bionomics of the Diaspines on Conifers and their Parasites in the coniferous Forests of Franconia.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 111–136, 10 figs., 20 refs. Berlin, 1951.

The Diaspines that attack conifers in Germany are *Carulaspis* (*Diaspis*) *visci* (Schr.), *Lepidosaphes newsteadi* (Šulc), the bisexual form of *L. ulmi* (L.) [*cf. R.A.E.*, A **22** 4], *Leucaspis loewi* Colv., *L. pini* (Htg.) (*candida* Targ.), *Syngenaspis parlatoriae* Šulc and *Dynaspidiotus abietis* (Schr.). All occur in Franconia (northern Bavaria), and investigations were carried out there in 1948–50 on their habits, food-plants and parasites, supplemented by a few observations near Munich in 1951. *Lepidosaphes newsteadi* and *Dynaspidiotus abietis* occurred on pine (*Pinus sylvestris*), Norway spruce (*Picea abies* (*excelsa*)) and silver fir (*Abies alba*) and were parasitised by *Aphytis mytilaspidis* (LeB.) and *Prospaltella aurantii* (How.). *S. parlatoriae* infested Norway spruce and was parasitised by *P. aurantii*, and *C. visci* was found on juniper (*Juniperus communis*), on which it was parasitised by *A. mytilaspidis*. The two species of *Leucaspis* occurred on *Pinus sylvestris*. *L. loewi* was parasitised by *Prospaltella aurantii*, *P. leucaspidis* Merc., *Azotus pinifoliae* Merc., and *Anthemus pini* Ferrière, and *L. pini* by *Aphytis mytilaspidis*, *P. aurantii*, *Azotus pinifoliae* and an unidentified Encyrtid. The bisexual form of *Lepidosaphes ulmi* occurred on *Abies alba* and was parasitised by *Aphytis mytilaspidis*, *Physcus testaceus* Masi, *Eusemion cornigerum* (Wlk.) and *Anabrolepis zetterstedtii* (Westw.). Notes on the bionomics of the parasites are included, and a key to the Coccids is appended.

ZWEIGELT (F.). **San-José-Schildlaus in Weinbau.** [The San José Scale in Viticulture.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 137–141. Berlin, 1951.

The San José scale [*Quadraspidiotus perniciosus* (Comst.)] attacks grape vines in Italy only when they are grown beneath or within about ten yards of infested fruit trees, and is practically absent from the vine-growing areas of Styria (Austria), where fruit trees and vines are not normally cultivated together. It is therefore considered that infestation of vines by the scale is largely accidental and depends on the close proximity of a more suitable food-plant. This view is supported by Malenotti's statement that only males developed on the leaves of vine and that, although females developed on the

petioles, their progeny were largely infertile. The author concludes that many of the food-plants recorded in the European literature will probably also not support successful development and reproduction [*cf. R.A.E.*, A **40** 312].

ANDERSEN (K. T.). **Temperatur und Feuchtigkeit als Faktoren der Lebensdauer überwinternder Larven des Zünslers *Pyrausta nubilalis* Hübn. und Thigmotaxis, Phototaxis und Hygrophilie als ökologische Faktoren.** [Temperature and Humidity as Factors in the Duration of Life of hibernating Larvae of *P. nubilalis*, and Thigmotaxis, Phototaxis and Hygrophily as ecological Factors.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 162–168, 3 figs., 3 refs. Berlin, 1951.

Investigations on the bionomics of *Pyrausta nubilalis* (Hb.) on hops in Germany showed that the larvae feed at first externally on the stems, then at points of contact between two stems or a stem and its support, and finally within the stems, in which they complete feeding, overwinter, and pupate in the following spring. An effective method of control is to burn the stems in autumn, but many larvae fall from these when they are pulled down and seek other shelter in or near the ground. In view of this, laboratory experiments were carried out on the effects of temperature and humidity on the survival of the full-fed larvae and the nature of the stimuli that cause them to bore into the stalks.

Field-collected overwintering larvae were kept in dishes at various temperatures between 0·4 and 29°C. [32·7 and 84·2°F.] and relative humidities between 17 and 86 per cent. Larvae kept at the higher temperatures and humidities pupated after averages of 68–125 days and gave rise to adults. The others failed to pupate but survived for averages of 109–144 days at the same humidities and lower temperatures, 49–111 days at 58 per cent. humidity, with the higher temperatures proving unfavourable, and 34–49 days at 17 per cent. humidity, with temperatures having little effect. The larvae preferred the most humid sites in the dishes, and when short lengths of glass tubing were placed in these they readily entered them, even in darkness, and remained in them. In further tests, the larvae were negatively phototactic, but the thigmotactic reaction was the more pronounced. The majority of the full-fed larvae in the hop stalks were found above the entrance holes, and with their heads directed downwards. The reasons for this position were unknown.

BECKER (G.). **Ausdehnung und Ablauf der *Dendroctonus*-Kalamität in Guatemala.** [The Extent and Course of the *Dendroctonus* Outbreak in Guatemala.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 186–209, 10 figs., 22 refs. Berlin, 1951.

The mountain slopes of Guatemala are covered by coniferous forests consisting largely of pines, the commonest of which above about 6,500 ft. are *Pinus rudis*, *P. ayacahuite* and *P. pseudostrobus*. In the absence of a developed system of forest management, considerable damage has been caused by *Dendroctonus* spp. The author carried out a survey of some of the affected areas in March-May 1951, and gives a preliminary account of his findings. Infestation was heavy and sporadic, and outbreaks had occurred over limited areas during at least the previous 25 years. The heaviest infestation observed occurred between Los Encuentros and Totonicapán and in the region of Tecpán, at altitudes of 8,000–10,000 ft., where groups of 100–2,000 dead trees, mostly of *P. rudis*, were found.

The species responsible for primary damage were *D. adjunctus* Bldf., *D. mexicanus* Hopk. and *D. parallelocollis* Chap., of which the first was the most injurious, numerous and widespread. Very few examples of *P. rudis* survived in infested areas, and some of *P. pseudostrobus* were also killed, but *P. ayacahuite*

was not attacked. At lower altitudes, *D. valens* Lec. infested and killed examples of *P. rudis* that were in a weakened condition. It is not known why *P. ayacahuite* resists attack. Adults of *Dendroctonus* fed on the bark in cages when no alternative food was offered. From a comparison of the numbers of brood galleries and exit holes at outbreak sites it was found that the rate of reproduction was high at the beginning of an outbreak but fell steadily thereafter from year to year. This was attributed to the influence of natural enemies, the most important of which were predacious Clerids. Guatemala forms the southern limit for *Dendroctonus*, and the genus is less injurious there than further north and its rate of spread not so great. Silvicultural methods ensuring the removal of tree stumps or other dead wood in which the beetles breed between outbreaks should give adequate control.

BLUNCK (H.). **Zur Kenntnis der Hyperparasiten von *Pieris brassicae* L. 4. Beitrag : *Gelis* cf. *transfuga* Först.** [Contributions to the Knowledge of the Hyperparasites of *P. brassicae*. Fourth Contribution : *Gelis* sp. near *transfuga*.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 217–267, 26 figs., 24 refs. Berlin, 1951.

In this further part of a series on the parasites of *Apanteles glomeratus* (L.), a parasite of *Pieris brassicae* (L.) in Germany [*cf. R.A.E.*, A **40** 280, etc.], an account is given of laboratory studies on the bionomics of a species of *Gelis* close to or identical with *G. transfuga* (Först.). It was taken in the field on several occasions between 1930 and 1950 but was not common. In addition to *A. glomeratus*, its field hosts included *A. rubecula* Marsh. and *Microplitis medianus* (Ruthe). *A. glomeratus* was the main laboratory host.

All stages of *Gelis*, its reproductive organs and the processes of pairing, oviposition, hatching, moulting and cocoon formation are described. The females are wingless, and the males have only rudimentary wings. Both sexes were rather inactive. The males survived in the laboratory for an average of one month, and the females for three months or more when sufficient food and moisture were available. They fed on sugar and on the body fluids of the host larvae or young pupae in their cocoons. The ratio of males to females in field-collected material was almost 1 : 5, but males greatly predominated in the laboratory. Since unfertilised females gave rise to males only, it is considered that fertilisation was rare in captivity, though pairing was frequent throughout adult life in many cases. There was a preoviposition period of up to a week at room temperature. Eggs were then laid by day or night at an average rate of 2–3 every 24 hours for some weeks or months if sufficient cocoons were provided and males were present. The maximum observed was 255 in 140 days by a female that then died of disease. Unfertilised females deposited far fewer eggs. Cocoons containing host larvae were preferred to those containing pupae, and fresh cocoons to those in which feeding or oviposition punctures had been made. Only one parasite developed on each host, though several eggs were sometimes laid. The durations of the egg, larval and pupal stages at various temperatures are shown in a table. At averages of about 17°C. [62·6°F.], they usually lasted some 2–4, 11–15 and 8–11 days, respectively. The larvae became full-fed in about a week and then spun their cocoons in those of the dead hosts, pupating about a week later, but this period was sometimes extended to several weeks or months, even at room temperature. Larvae that became full-fed in autumn overwintered and pupated in the following spring. The adults remained in the cocoon for up to five days after emerging.

Complete development from egg to adult lasted 3–4 weeks at room temperature and 9–14 days at the optimum (30°C. [86°F]). There were probably 3–4 generations a year in the field. In view of the abundance of its host and

the high fecundity of the females, *Gelis* should be common. The reasons for its rarity are unknown. Mortality was fairly high among the eggs and young larvae, but no natural enemies are known and attack by bacteria, fungi or other diseases was rare. The few cases observed in the laboratory are described.

WIESMANN (R.) & KOCHER (C.). **Untersuchungen über ein neues, gegen resistente *Musca domestica* L. wirksames Insektizid.** [Investigations on a new Insecticide effective against resistant Strains of *M. domestica*.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 297–321, 7 figs., 28 refs. Berlin, 1951.

An account is given of investigations on 1-phenyl-3-methyl-pyrazolyl-(5)-dimethylcarbamate, a urethane referred to as Pyrolan or G.22008 that was synthesised in Switzerland during work on the control of strains of *Musca domestica* L. resistant to DDT. It is a crystalline substance that melts at 50°C. [122°F.], is soluble in most organic solvents and has a solubility of 0·1 per cent. in water at 20°C. [68°F.]. It has hydrophilic and lipophilic properties, but is only slightly absorbed through the skin. The median lethal doses for rats and mice *per os* were 62 and 90 mg. per kg., respectively, so that its toxicity to these animals is about the same as that of rotenone.

Studies on its general insecticidal properties showed that Pyrolan was not toxic to Lepidopterous larvae, nymphs of *Periplaneta* (*Blatta*) *americana* (L.) or adults of *Melolontha melolontha* (L.) that ingested it, but was toxic *per os* to insects that feed on liquids, the median lethal doses in mg. per kg. being 24 and 0·5 for adults of *Autographa* (*Plusia*) *gamma* (L.) and *Ephestia kuehniella* Zell., respectively, 13 for honey bees and 3·2 for adults of *Musca domestica*. Its toxic effect was rapid, a dose of 0·5 mmg. per fly causing complete knock-down and mortality in 14 minutes and 24 hours, respectively, of adults of a strain of *M. domestica* fairly resistant to DDT ; lower doses also caused knock-down, but some of the flies recovered from it. It was toxic by contact to insects of several orders exposed to deposits of 1 mg. or less per 100 sq. cm. from acetone solutions, the periods of continuous exposure to 1 mg. giving complete knockdown being 30 and 10 minutes for adults and larvae of the resistant *M. domestica*, 24 hours for *Cimex lectularius* L. and a tick (*Ornithodoros*), 72 hours for *Calandra granaria* (L.), and 42 minutes for *Aphis rumicis* L. ; it was not toxic to *P. americana* at that rate, but caused complete knockdown in 9 hours at 10 mg. per 100 sq. cm., and was ineffective against larvae of *E. kuehniella* and *Tenebrio molitor* L. The concentrations required in water for 50 per cent. kill of larvae of *Aëdes aegypti* (L.) and Trichoptera were 3,000 and 3 parts per million, respectively.

The symptoms of poisoning were characteristic and independent of method of application. Affected insects lay on their backs and showed recurrent tremors of the extended extremities, accompanied by movements of the mouth-parts and oesophagus leading to swallowing of air [*cf. R.A.E.*, A **40** 360].

In investigations on the site and mode of action, in which *P. americana* was the test insect, decapitation before or after treatment did not reduce the tremors in cockroaches into which Pyrolan was injected, and injection into the head capsule or the cerebral and suboesophageal ganglia caused movements of the mouth-parts only, so that the brain was apparently not the site of toxic action. Topical application of a 0·1 per cent. aqueous solution of Pyrolan to the exposed thoracic ganglia caused typical tremors of the extremities, and these continued when the longitudinal connectives were severed and were merely altered in rhythm when the thoracic segments were dissected from the body. Treatment of the ganglia with 2·5 per cent. barbituric acid following treatment with Pyrolan reduced or suppressed the tremors, and Pyrolan applied to ganglia previously treated with barbituric acid reversed the

paralytic effect of the latter. Treatment of a thoracic ganglion with nicotine suppressed the tremors in the corresponding extremities but not in the other pairs. Injection of a mixture of Pyrolan and DDT caused tremors typical of both, and subsequent treatment of the ganglia with nicotine suppressed the Pyrolan component but had only a slightly weakening effect on the DDT symptoms. When the leg-nerves of cockroaches affected by Pyrolan were severed close to the ganglia, the tremors ceased at once. It is concluded that tremors occur only in the presence of an intact reflex arc, and that unlike DDT [*cf.* **38** 233], Pyrolan acts centrally on the motor region of the ganglia.

In tests on the transport of Pyrolan in the body, topical application to the exposed lowest abdominal ganglion did not cause tremors of the extremities, but the cerci were affected, and injection of Pyrolan solution into the left fore-leg caused tremors in that leg in about five minutes, in the right fore-leg in 8–10 minutes, in the second pair in 40–50 minutes, and in the hind pair in 55–60 minutes. When the longitudinal connectives of the thoracic ganglia were severed, the tremors ceased in the hind legs after 4–6 minutes and then in the middle pair, whereas they persisted for an hour in the fore-legs. It appears that Pyrolan is transported in the endoneural lymph canals over only short distances. It apparently penetrates into the ganglia, since washing in water following its topical application to them had no effect. Injection of 0·05 cc. of a 0·1 per cent. aqueous solution of Pyrolan into the abdominal part of the heart caused no toxic symptoms, but blood taken after 15 minutes from insects so treated was toxic to *M. domestica*. Blood taken after an hour was not toxic, so that Pyrolan is apparently rapidly decomposed in insect blood. Further bioassay with *M. domestica* showed that Pyrolan was present in the organs of cockroach nymphs 2–4 hours after they had been knocked down by contact with a deposit. Pyrolan increased respiration, carbon-dioxide production and water loss in treated insects, and slightly increased the acidity of the blood and muscles, probably as a result of lactic-acid production. Death appeared to be due to exhaustion combined with autointoxication.

The further work described was carried out with a view to the use of Pyrolan against DDT-resistant strains of *M. domestica* [*cf.* B **41** 70].

SCHRADER (G.). **Zur Kenntnis neuer Insektícide auf Grundlage organischer Phosphorverbindungen.** [Contribution to Knowledge of new Insecticides on a Basis of organic Phosphorus Compounds.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 328–340, 1 graph, refs. Berlin, 1951.

The author briefly reviews the work done in Germany on the development of the modern phosphorus insecticides [*cf. R.A.E.*, A **40** 325–327] and gives notes on their preparation and chemical composition. Parathion is the most generally useful of them and is the one dealt with in most detail. Its physical properties and some of the ways in which it and its methyl homologue are used in proprietary insecticides in Germany [*cf.* **40** 323, note] are described. The toxicity of parathion is generally ascribed to inhibition of cholinesterase, but it is not known whether its great rapidity of action is due to this or to some other factor. The power of inhibiting bee cholinesterase and the toxicity to insects of parathion and some homologues and analogues of it are shown in a table. Work by G. Hecht & W. Wirth (1950) has shown that the median lethal doses *per os* for rats in mg. per kg. are 6·4 for parathion, 15–20 for methyl-parathion, 3 for paraoxon and 3·4–6·8 for the methyl homologue of paraoxon, and that the concentrations of these four compounds in mmg. per cc. giving 50 per cent. inhibition of horse-serum cholinesterase are 0·73, 17, 0·0036 and 0·033, respectively. In spite of the great difference in cholinesterase inhibition between parathion and paraoxon, their toxicity to insects is about the same, so that the former is not an accurate index of the latter.

WILLE (J. E.). **Erfahrungen mit organischen Insektiziden in der Bekämpfung von Baumwollschädlingen in Perú.** [Experience with organic Insecticides in the Control of Cotton Pests in Peru.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 341–348, 7 refs. Berlin, 1951.

The author recapitulates work in 1946–50 showing that chlorinated-hydrocarbon insecticides cause large increases in *Heliothis virescens* (F.) on cotton in Peru by killing its natural enemies, whereas protection of the latter leads to good control [*R.A.E.*, A **39** 264], and states that the sowing of maize between the cotton plants gave as good results in 1950–51 as in 1949–50. An outbreak of the cotton leafworm, *Anomis texana* Ril. [previously cited erroneously (*loc. cit.*) as *Alabama argillacea* (Hb.), which is of importance in Peru only in the north], occurred during the season and was controlled by calcium arsenate. A single treatment of one field with a dust of 5 per cent. DDT in sulphur led to heavy infestation by *H. virescens*, and one application to others (against *Anomis*) of a dust of 20 per cent. toxaphene and 40 per cent. sulphur was followed by successive outbreaks of *H. virescens*, *Aphis gossypii* Glov. and *Anthonomus vestitus* Boh., which destroyed almost all the crop.

GROSCHKE (F.). **Nonnenbekämpfung mit neuzeitlichen Mitteln.** [Control of *Lymantria monacha* by modern Methods.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 359–368, 5 refs. Berlin, 1951.

Large-scale control of *Lymantria monacha* (L.) in pine forests with an undergrowth of spruce was undertaken in Bavaria near Aschaffenburg in 1948 and near Weiden in 1950. In 1948, about 680 acres were dusted with Gesarol (5 per cent. DDT) at 47·7 lb. per acre, and nearly 75 acres, mostly of unmixed pine, with a proprietary BHC powder (containing 6·5 per cent. active ingredient) at 45 lb. per acre. The intensity of infestation and the results of the treatments were evaluated by collecting excreta or by sawing off the branches of sample trees and counting the larvae on ground sheets. The treatments were carried out in May, when most of the larvae were in the second instar on pine and in the third or fourth instar on spruce. Six days after treatment, mortality averaged 98·2 per cent. for DDT and 99·6 per cent. for BHC. Despite the high average mortality, BHC was more variable in its effectiveness than DDT, and it is concluded that it is not reliable for the control of *L. monacha*. A BHC smoke gave low mortality.

In 1950, a thermal aerosol generator (TIFA) [*cf. R.A.E.*, A **35** 259] was used to apply a DDT fog. In a preliminary test in May it was driven through the forest in the early morning at a speed allowing the release of 2 lb. DDT per 100 yards travelled, and 99·2–100 per cent. of the larvae in a band 220 yards wide, measured from the path of the apparatus, were dead after nine days. In the main operation, in May–June, against second-instar larvae about 1,900 acres were treated with the DDT fog and 550 acres with the 5 per cent. dust. Six days later, the mortality percentages on spruce averaged 92·6 and 91·9, respectively. Two other areas were treated with the fog a month later, when the larvae were in the third, fourth or fifth instars, and mortality averaged 95 per cent. after five days.

DAHM (P. A.). **Effects of Weathering and commercial Dehydration upon Residues of Aldrin, Chlordane, and Toxaphene applied to Alfalfa.**—*J. econ. Ent.* **45** no. 5 pp. 763–766, 4 refs. Menasha, Wis., 1952.

The following is based largely on the author's summary. The results are given of a further experiment carried out in Kansas to assess the effects of weathering and commercial dehydration on residues of aldrin, chlordane and

toxaphene applied to lucerne at the rates generally recommended for insect control [*cf. R.A.E.*, A **39** 267]. The three materials were applied by a compressed-air sprayer at 2 oz., 1 lb. and 1·5 lb. per acre, respectively, in emulsion concentrates diluted with about 20 U.S. gals. water. The lucerne was 14–20 ins. high at the time of treatment, and less than 0·1 inch of rain fell during the following 18 days.

Lucerne samples gathered immediately after spraying and 18 days later, respectively, contained 2 and less than 0·1 part per million aldrin, 12 and 3 p.p.m. chlordane and 30 and 14 p.p.m. toxaphene, and samples taken from loads of cut and chopped lucerne from the same plots just before and after these were processed by a commercial drier contained less than 0·1 p.p.m. aldrin, 2 and 1 p.p.m. chlordane and 6 and 5 p.p.m. toxaphene. Except for those obtained after processing, values were based on the wet weight of the samples ; corresponding values based on dry weight are also given.

Carman (G. E.), Gunther (F. A.), Blinn (R. C.) & Garmus (R. D.). **The physical Fate of Parathion applied to** *Citrus*.—*J. econ. Ent.* **45** no. 5 pp. 767–777, 4 figs., 21 refs. Menasha, Wis., 1952.

Owing to the high rates at which parathion is applied for the control of *Aonidiella aurantii* (Mask.) and other injurious insects on *Citrus* in California, danger may be involved in the use of the treated commodity and in the exposure of man or animals to the contaminated environment. Investigations were therefore carried out in the laboratory and field on contamination of the atmosphere round treated plant parts. The procedures and apparatus used are described in detail. Because of the nature of the problem, it was necessary to determine contamination in a stream of air.

The laboratory tests were designed to elucidate the factors controlling the re-issuance or vaporisation of parathion existing as extra-cuticular or sub-cuticular residues on field-sprayed oranges ; losses due to metabolic degradation or interaction with enzyme systems are to be dealt with later. A current of air was passed over the sprayed oranges and then through two lots of benzene, to absorb any parathion in it. This was continued for 15–62 days, and the air was diverted every other day before it reached the benzene and passed through a cage containing house-flies [*Musca domestica* L.] Analysis of the total parathion contents of the fruits at the end of the experiment, of similarly sprayed but unaired fruits, and of the benzene showed that the losses of parathion from the fruits were much greater than the amounts absorbed by the benzene and were therefore not due to re-issuance of the compound to the surface, followed by volatilisation or other physical displacement ; wettable-powder and emulsion sprays gave similar results, and there was no mortality of the exposed house-flies. Neither intense fluorescent illumination nor complete exclusion of light had any appreciable effect on the rate of parathion loss or on house-fly mortality. Similar treatment of shallow layers of a wettable powder resulted in only 5–6 per cent. loss of parathion in 27 days ; parathion was not recovered from the benzene and house-flies were not killed.

In the field, an apparatus was used that continuously sampled large volumes of air in *Citrus* groves sprayed 1–9 days previously and simultaneously indicated the amount of parathion in the total air sample at any given time by degree of ultraviolet absorption at 274 millimicrons and by bioassay with house-flies. In addition, colorimetric analysis was used to detect parathion in the final solutions obtained. The results showed that parathion did not occur as a vapour in the sprayed groves in amounts within the detectable range of the apparatus, which was very sensitive, the combination of ultraviolet and colorimetric analysis indicating not more than 0·05 mg. parathion vapour per cu.m. air in any of the nine investigated, but that particles containing parathion may be present in small amounts.

PAINTER (R. H.), JONES (E. T.) & HEYNE (E. G.). **Hessian Fly Resistance of Ponca Wheat.**—*J. econ. Ent.* **45** no. 5 pp. 778–783, 2 figs., 6 refs. Menasha, Wis., 1952.

The following is substantially the authors' summary. Ponca wheat, a selection from the cross (Kawvale × Marquillo) × (Kawvale × Tenmarq), was produced in Kansas in the course of work on strains resistant to *Mayetiola* (*Phytophaga*) *destructor* (Say); it showed resistance to the fly in widely separated parts of the United States in 1941–51. The percentages of plants infested in this and the susceptible Tenmarq variety were 2 and 75, respectively, in 27 comparisons in the hard-wheat area of Kansas, and 6 and 85 in 25 comparisons in the soft-wheat area of Missouri. Ponca has greater resistance to *M. destructor* and leaf rust, but less bunt resistance and winter hardiness than Pawnee, the variety most commonly grown in eastern Kansas; the two do not differ in other characteristics of importance. It is concluded that if Ponca wheat is grown extensively in eastern Kansas, the population of *M. destructor* may be so reduced as to become insignificant.

BARTLETT (B. R.) & ORTEGA (J. C.). **Relation between natural Enemies and DDT-induced Increases in Frosted Scale and other Pests of Walnuts.**—*J. econ. Ent.* **45** no. 5 pp. 783–785, 5 refs. Menasha, Wis., 1952.

Sprays of DDT applied for the control of the codling moth [*Cydia pomonella* L.] to English walnuts in southern California have resulted in increased populations of *Chromaphis juglandicola* (Kalt.), *Tetranychus bimaculatus* Harvey, *Paratetranychus pilosus* (C. & F.) and *Eulecanium* (*Lecanium*) *pruinosum* (Coq.) [*cf. R.A.E.*, A **36** 155]. A reduction in the activity of general predators is at least partly responsible for the increase of the Aphid and mites, but not for that of the Coccid. Much evidence has been obtained in the last few years of a cyclic increase in *E. pruinosum*, accompanying an abnormal increase in Lecaniine scales attacking *Citrus*, and it has been suggested that such trends may be associated with an unfavourable effect of a succession of cold dry winters on the development of Hymenopterous parasites. There is no evidence that the increase in orchards not treated with DDT is due to a general decrease in the activity of natural enemies, such as might result from a lethal effect on migrant parasites in treated areas.

A critical examination of increases of *E. pruinosum* associated with DDT showed that they were due to the direct effect of the DDT on *Metaphycus californicus* (How.). This Encyrtid attacks only *E. pruinosum*, so far as is known, and apart from *Blastothrix sericea* (Dalm.), which is rare, is its only parasite in southern California. The only hyperparasite observed is *Thysanus* sp., which attacks *M. californicus* to a limited extent. *M. californicus* parasitises *E. pruinosum* from the time the scales reach a length of about 0·6 mm., developing as a solitary parasite in the young stages and gregariously in the older ones. Most of the Coccids hatch in May or June, when adults of *M. californicus* are abundant in the field. They develop slowly during the late summer, and parasite attack becomes evident in September and October, increases during the winter and may be extensive by late February and March, when the male scales emerge. Scale development is very rapid in March-May, and parasitism continues without interruption until, in May or June, *M. californicus* is found emerging from Coccids that have appreciable numbers of eggs hatching under them. Up to 25 or more parasites emerge from single full-grown hosts. This uninterrupted attack makes control by the parasite extremely effective.

May applications of DDT at about 6 lb. actual compound per acre against *C. pomonella* retard parasite activity only during the late-adult and early developmental stages of the scale, and are thus made at the least detrimental period. Natural control may be partly upset, but if dosages are kept as low

as possible, the scale increase is only temporary and is easily controlled by the parasite. If second applications are necessary, residues that will kill the parasites persist into the late summer and permit the development of scale infestation too severe for parasite control.

It is suggested that where relatively heavy infestation by *E. pruinosum* occurs, a schedule of reduced dosages of DDT, and particularly the use of only a single application, will permit satisfactory control of the Coccid by *M. californicus*.

GAINES (J. C.), PFRIMMER (T. R.), MERKL (M. E.) & FULLER (F. M.). **Insecticidal Control of Thrips on Cotton.**—*J. econ. Ent.* **45** no. 5 pp. 790–794, 6 refs. Menasha, Wis., 1952.

In the tests in Texas described, the thrips present on the cotton were *Frankliniella tritici* (Fitch), *F. fusca* (Hinds) and *F. exigua* Hood, and no attempt was made to separate them in recording the results. The sprays were in the form of emulsions applied at about 2·5 U.S. gals. per acre with a power sprayer. Sprays of EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate], parathion, γ BHC, aldrin and dieldrin at 0·08 lb. per acre, DDT at 0·26 lb. and toxaphene at 1·05 lb. were all effective immediately after application on 3rd May and for seven days after a second application on 18th May. After the first treatment, dieldrin, toxaphene and DDT were effective for five days, but ineffective after 11. The seasonal averages of the thrips populations indicated that parathion and γ BHC were less effective than the other materials. After spray application to late-planted cotton on 7th June, EPN, aldrin and dieldrin at 0·07 lb. per acre, parathion at 0·13 lb., DDT at 0·25 lb., toxaphene at 0·98 lb. and a mixture of γ BHC and DDT (3 : 5) at 0·2 lb. were very effective for 2–3 days, but the toxicity of parathion and the mixture was much reduced by the fourth day. Dieldrin was the most effective material 14 days after application and also 11 days after a second application on 22nd June. The seasonal averages of population indicated that dieldrin, toxaphene and aldrin were equally effective ; DDT, EPN, parathion and the mixture showed less persistent toxicity than the other compounds.

When applied on 15th May, sprays of toxaphene, aldrin and dieldrin at 0·8, 0·1 and 0·06 lb. active material per acre, respectively, and dusts of the same materials at 0·95, 0·11 and 0·07 lb. per acre were all equally effective; there was little difference in the persistence of dusts and sprays of the same compound. Schradan failed to control the thrips when applied in a spray at 0·25 lb. per acre on 7th May, but gave good control, apparently by contact action, at 0·75 lb. on 18th May. Systox [O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate], applied at the same rates, was more effective, but apparently neither gave systemic control. Sprays of parathion at 0·15 and toxaphene at 0·77 lb. per acre were about as effective as Systox. Sprays of malathon and Systox at about 0·25 lb. per acre and dieldrin and Compound 269 (a stereoisomer of it [recently named endrin]) at 0·06 lb. all gave good control immediately after application. Malathon and Systox showed poorer residual toxicity than dieldrin, and dieldrin remained effective for a little longer than its isomer.

HOERNER (J. L.) & LIST (G. M.). **Controlling Cherry Fruitworm in Colorado.**—*J. econ. Ent.* **45** no. 5 pp. 800–805, 1 fig., 8 refs. Menasha, Wis., 1952.

Severe injury to cherry fruits in northern Colorado in 1945 was caused by *Cydia* (*Grapholitha*) *packardi* (Zell.), *C.* (*G.*) *prunivora* (Walsh), *Mineola scitulella* Hulst and *Tachypterellus consors cerasi* List, but the first of these, which has been present in the State for at least 35 years, was the most harmful in 1946–50.

The moths appear from about the beginning of June and lay their eggs on the fruits or on the stems near them. The eggs hatched in a week in the laboratory. The larvae enter the fruit within a few hours, tunnel round the stone for about three weeks, and overwinter in the pruned stubs of dead twigs, under the bark, in the stem of weeds and grasses or in the ground. They pupate in the following May, and the pupal stage averages 29 days. There is usually only one generation a year, but a partial second occurred in 1946. Infestation of 2–3 per cent. of the fruits is common, and 30–60 per cent. infestation was observed in light crops. Practically all the larvae leave the cherries before harvest. When the fruits are put in tanks of water most of the injured ones float, but a few sink with the sound cherries, and it is practically impossible to separate them.

In experiments on control in 1946, DDT at 1 lb. per 100 U.S. gals. in wettable powder was more effective then lead arsenate, cryolite, rotenone or nicotine with summer oil when applied 2–3 times in May and June, but resulted in increased injury by the two-spotted mite [*Tetranychus bimaculatus* Harvey] and in one case in excessive residues at harvest. In 1947, DDT at 0·75 lb. per 100 U.S. gals. and p,p'methoxy-DDT (methoxychlor), applied 2–3 times at 1 lb. per 100 U.S. gals. in a wettable powder, gave the best control. In 1948, all the treatments tested gave significant control, but parathion at 2 lb. 25 per cent. wettable powder, p,p'methoxy-DDT and DDD at 2 lb. 50 per cent. wettable powder and DDT at 1·5 lb. 50 per cent. wettable powder per 100 U.S. gals. applied 2–3 times, and p,p'methoxy-DDT applied once at 4 lb. per 100 U.S. gals., were more effective than any others. A power sprayer gave better results than a compressed-air sprayer with DDT and methoxy-DDT. Residues were excessive after three applications of DDT. About 1 per cent. of the larvae collected in 1948 were parasitised, most by *Ascogaster quadridentata* Wesm. and a few by *Bassus* sp.

In 1949, two applications of 1 lb. DDT per 100 U.S. gals. were ineffective, but 2–3 of 1–2 lb. 15 per cent. wettable parathion gave very good control and 2–3 of 1–2 lb. 50 per cent. p,p'methoxy-DDT fairly good control, which was not improved by the addition of nicotine sulphate and oil, in an orchard in which 9·5 per cent. of the fruits were infested on untreated trees, but were inadequate in one in which 16 per cent. of the untreated fruits were infested. *C. packardi* appeared on chokecherry (*Prunus virginiana*), a native food-plant, about a month later than on cultivated cherry. In 1950, combined sprays of 2 lb. 15 per cent. parathion and 2 lb. 50 per cent. p,p'methoxy-DDT or half these quantities per 100 U.S. gals. were less effective than parathion alone, and sprays of 0·5 lb. aldrin, 1 lb. 25 per cent. γ BHC as lindane or 4 oz. dieldrin per 100 U.S. gals. were significantly inferior to parathion or methoxy-DDT.

CHAPMAN (P. J.), LIENK (S. E.) & CURTIS jr. (O. F.). **Responses of Apple Trees to Mite Infestations : I.**—*J. econ. Ent.* **45** no. 5 pp. 815–821, 2 graphs, 5 refs. Menasha, Wis., 1952.

The following is based on the authors' summary. The results are given of the first year of investigations on the effect of mites on the productivity of apple trees in New York. Half the trees in two young orchards were kept virtually free of mites in 1951 by the application of acaricides, and mites were allowed to develop unchecked on the others. All the trees received sprays against insects and diseases.

Heavy populations of *Paratetranychus pilosus* (C. & F.) developed on the untreated trees, but *Tetranychus bimaculatus* Harvey was unimportant, although it occurred on the trees and cover crop. Among the varieties of apple that produced normal crops in 1951, trees on which mites were controlled produced more bushels of fruit and more fruits per tree, but the increases were not statistically significant except for the Cortland variety, on which they averaged

27·8 and 23·1 per cent., respectively. Mite infestation apparently had no effect on fruit growth, but uninfested trees made more trunk growth. Fruit colour was better on the infested Cortland trees, apparently because the less dense growth permitted better penetration of sunlight to the less exposed fruits. Mite feeding reduced the chlorophyll content of the leaves by 15–35 per cent., depending on the variety and intensity of infestation. There was no apparent effect on fruit firmness at harvest or after storage for several months or on the content of total soluble solids.

HOPKINS (L.) & GYRISCO (G. G.). **Tests on Pea Aphid Control in Alfalfa and Residues from various Formulations at Harvest.**—*J. econ. Ent.* **45** no. 5 pp. 821–825, 2 refs. Menasha, Wis., 1952.

A heavy infestation of *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) on lucerne in Oswego county, New York, in 1950 afforded an opportunity for testing various insecticides against that Aphid and of studying residues and methods of application. When BHC, toxaphene, dieldrin and aerosol and technical grades of DDT were applied in emulsion sprays by a low-pressure sprayer at 0·3 lb. toxicant in 15 U.S. gals. per acre to lucerne 22 ins. high, the two grades of DDT gave good control for a week with little difference between them, and were the best of the materials tested. DDT was somewhat less effective on lucerne 33 ins. high, even when applied at 0·5 lb. per acre, probably owing to poorer coverage. Impregnated dusts of either grade of DDT gave good control for about ten days when applied at 2 lb. toxicant per acre to the stubble or when the lucerne was 2, 4 or 6–8 ins. high, and were about as effective as a regular 5 per cent. ribbon-mill dust at 50 lb. DDT per acre, which was slightly inferior to the low-pressure spray. A thermal aerosol applicator (TIFA) [*R.A.E.*, A **35** 259] gave good control for a limited distance from the nozzle, 3 per cent. oil solutions and emulsified solutions of the aerosol and technical grades of DDT giving comparable results.

Samples of lucerne for residue analysis were taken after each application and at harvest. DDT residues from the emulsion sprays were much the most persistent. Those from the various dusts were about equal at harvest, showing that the toxicant is lost in amounts proportional to those applied. They were greater immediately after application on lucerne 4 ins. high. Residues from the aerosols indicated that effective control extends over about 25 ft. from the nozzle, the solutions and emulsified solutions being equally persistent.

ROAN (C. C.). **Tagging Oriental Fruit Flies with Radioactive Phosphorus for Field-Movement Studies.**—*J. econ. Ent.* **45** no. 5 pp. 826–828, 2 graphs, 3 refs. Menasha, Wis., 1952.

Various methods of marking Diptera with radioactive phosphorus for field-movement studies were tested for use on *Dacus ferrugineus dorsalis* Hendel. In the first test, potassium dihydrogen phosphate containing radioactive phosphorus (P^{32}) was added to the carrot medium used for routine rearing of the larvae at the rate of 0·1 or 0·34 microcurie P^{32} per ml., and 500 eggs were placed on 200 ml. of the mixture. Development of the larvae lasted about six days. Third-instar larvae, pupae and adults were assayed for radioactivity, and it was found that although the adults showed high degrees of radioactivity, the differences due to the two concentrations of P^{32} were not adequate to distinguish in all cases between individuals from different samples. However, the fruit-flies were sufficiently radioactive to permit their identification in releases made at time intervals of the half-life of P^{32} (14·3 days) by taking advantage of radioactivity decay and excretion losses.

In the second test, 600 adults were kept without food or water for 24 hours allowed to feed for 24 or 48 hours on a sugar solution containing 3·9 microcuries P^{32} per ml., and then restored to the normal diet. Assays showed that the differences in radioactivity between the two groups of fruit-flies were not adequate for the positive identification of all adults according to the period of feeding, and the lack of uniformity suggested that this method would be of questionable value for the identification of examples released at different times.

When groups of fruit-flies, each containing some radioactive examples, were stored for a week in a lure solution at room temperature and then tested in a Geiger-Müller tube, those marked by feeding either in the larval or adult stage could be detected for 40 days after emergence or feeding. The assay of individuals at different intervals after marking showed that the rate of loss of radioactivity differed with the method of marking, probably owing to differences in the biochemical distribution and rate of turnover of the P^{32}. Females reared from marked larvae lost P^{32} more rapidly than the males, and 80 mg. eggs collected from them 15 days after emergence gave a reading of 1,000 counts per minute.

Neither treated adults nor adults from treated larvae showed adverse effects from exposure to the different levels of radiation. Those from treated larvae resembled the normal laboratory strain in percentage emergence from pupae, fecundity, fertility, viability of larval progeny and length of life under laboratory conditions, and the use of P^{32} did not complicate normal rearing procedures unduly.

Campbell (W. V.) & Hutchins (R. E.). **Toxicity of Insecticides to some predaceous Insects on Cotton.**—*J. econ. Ent.* **45** no. 5 pp. 828–833, 10 refs. Menasha, Wis., 1952.

The authors give a list of the predacious insects found on cotton at Stoneville, Mississippi, in the summer of 1951, which included eight species of Coccinellids, three of Hemiptera, with unidentified Reduviids, a species of *Chrysopa* and Mantids, record the prey attacked by the different species and give the results of laboratory and field investigations on the effect of insecticides on the more important.

In the laboratory tests, parathion and Compound 269 (a stereoisomer of dieldrin [recently named endrin]) were tested at 0·1 lb. per acre, EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] and Compound 711 (a stereoisomer of aldrin [recently named isodrin]) at 0·2 lb., dieldrin, aldrin, and heptachlor at 0·15, 0·25 and 0·35 lb., respectively, γ BHC, DDT and chlordane at 0·4, 0·5 and 1 lb., respectively, and Compound 923 [2,4-dichlorophenyl benzenesulphonate], toxaphene and calcium arsenate at 2, 2·5 and 10 lb., respectively. Sprays and dusts of aldrin, dieldrin, chlordane, EPN, γ BHC, heptachlor, parathion and toxaphene gave complete kills of *Nabis ferus* (L.) and *Geocoris punctipes* (Say), sprays and dusts of endrin and sprays of DDT and Compound 923 gave complete kill and a spray of isodrin and a dust of DDT 67 and 25 per cent. kills of *N. ferus*, and DDT in a spray or dust complete kill and Compound 923 in a dust 50 per cent. kill of *G. punctipes*. Although endrin, γ BHC and toxaphene in sprays or dusts and calcium arsenate in a dust caused at least 70 per cent. mortality of *Ceratomegilla fuscilabris* (Muls.), only EPN and parathion in either form completely eliminated it ; aldrin, isodrin and heptachlor caused low mortalities. Aldrin, dieldrin, isodrin, endrin, chlordane, γ BHC, DDT, heptachlor and Compound 923 in sprays or dusts caused low mortality of *Hippodamia convergens* (Guér.), but EPN and parathion were highly toxic and toxaphene fairly so. Compound 923 in a spray caused complete kill and γ BHC 92 per cent. kill of *Scymnus* sp., chlordane and isodrin were little toxic, and toxaphene, aldrin, dieldrin and heptachlor were intermediate in effect.

In general, all the insecticides affected the predators, and only DDT was consistently less injurious as a dust than as a spray. Isodrin caused less mortality than any other material used.

In field tests on plots receiving nine spray applications in May–August, dieldrin applied at 0·15 lb. per acre in the first seven and at 0·3 lb. in the last two caused less reduction in total predators than DDT and toxaphene applied at 0·5 and 2·5 lb., respectively, in the first seven and 1 and 3 lb. in the remainder. Hemiptera were more seriously affected than Coccinellids, which were the most abundant predators present. The predators were most numerous in early June and early August and scarce in July, when they were found to be very numerous and breeding on maize. The application of insecticides to cotton during the latter period and the use of some of the less injurious materials might reduce the destruction of beneficial insects. The numbers of predators on cotton decreased as the distance from a neighbouring maize field increased, which suggested the possibility of increasing the population of predators on cotton by planting a crop harbouring suitable prey adjacent to it [*cf. R.A.E.*, A **41** 136].

STEINER (L. F.). **Fruit Fly Control in Hawaii with Poison-bait Sprays containing Protein Hydrolysates.**—*J. econ. Ent.* **45** no. 5 pp. 838–843, 2 refs. Menasha, Wis., 1952.

The following is substantially the author's summary of this account of preliminary experiments in Hawaii in 1950–51. The addition of 5 per cent. enzymatic protein hydrolysates of soy bean or yeast greatly increased the attractiveness to *Dacus ferrugineus dorsalis* Hendel and *Ceratitis capitata* (Wied.) of bait-sprays containing 25 per cent. raw sugar and 3 per cent. Metacide [an emulsion concentrate containing 6·2 per cent. parathion and 24·8 per cent. methyl-parathion] or 4 per cent. of a 25 per cent. wettable parathion powder. EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] and γ BHC as lindane, in wettable powders, and an emulsified solution of Compound 22008 (1-phenyl-3-methyl-pyrazolyl-(5)-dimethylcarbamate) [Pyrolan (*R.A.E.*, A **41** 134)] in isopropyl alcohol were also very effective when supplemented with sugar and protein hydrolysate. Replicated tests, in which small areas of guava foliage were treated and trays were placed under them to catch the dead fruit-flies, indicated that such sprays were most effective while the deposits were drying. About 62 per cent. of all the fruit-flies attracted to dilute bait-sprays on guava foliage appeared during the first day and less than 10 per cent. after the third. However, good catches were made for as long as a week where concentrated bait-sprays were applied. Maximum attraction was associated with tacky deposits. Since the bait-sprays containing protein hydrolysate attracted fruit-flies for distances of at least 50 ft., less thorough coverage was required of these than of conventional residual-type sprays. They were also less harmful to parasites. Deposits from bait-sprays containing slow-acting poisons, such as DDT, dieldrin, aldrin, chlordane and nicotine bentonite, failed to kill fruit-flies rapidly enough for reliable evaluation of their effectiveness by the methods used.

In small-plot tests, bait-sprays containing protein hydrolysate, sugar and parathion gave excellent control of *D. f. dorsalis* on banana and good control on mango and guava, and were effective for 2–3 weeks after each application. In semi-isolated guava gulches, average reductions of 87–94 per cent. in the numbers of larvae were obtained with 4 oz. parathion per acre applied at intervals of three weeks in a protein-sugar bait-spray, whereas DDT gave 82 per cent. control when applied alone at 1·5 lb. per acre in a wettable-powder spray.

Taylor (L. F.), Apple (J. W.) & Berger (K. C.). **Response of certain Insects to Plants grown on varying Fertility Levels.**—*J. econ. Ent.* **45** no. 5 pp. 843–848, 10 refs. Menasha, Wis., 1952.

The following is largely based on the authors' summary. The experiments described were carried out in Wisconsin in an attempt to determine whether plant nutrient elements have any effect on the abundance of certain plant-feeding insects. Greenhouse tests showed no significant differences in the reproductive capacity of *Macrosiphum solanifolii* (Ashm.) on potato plants grown at high and low levels of nitrogen, phosphorus and potassium. Deficiency symptoms and quantitative chemical tests for the elements involved showed that deficiencies of the various elements existed in the plants grown at low nutrient levels. Field observations in 1950–51 in cages, in which the numbers and movement of the Aphids were controlled, and in uncaged plots failed to reveal any significant differences in the reproductive capacity of *M. solanifolii* on plants grown at various fertility levels, but there was distinct evidence of an influence on migrating Aphids early in the season, the Aphids showing a preference for the most mature plants and those with the most vegetative growth.

Greenhouse tests showed no significant differences in the reproductive capacity of *M. pisum* (Harris) (*pisi* (Kalt.)) on pea plants grown at high and low levels of nitrogen, phosphorus and potassium [*cf. R.A.E.*, A **40** 120], and one experiment revealed no differences in the fecundity or length of life of the Aphid on plants grown at high and low nitrogen levels, though quantitative analyses showed that the former contained a higher proportion of nitrogen. In field tests with both caged and uncaged Aphids, no differences in reproductive capacity were observed, and small plants in uncaged plots attracted and supported as large a population as large succulent ones.

In greenhouse tests, larvae of *Pyrausta nubilalis* (Hb.) showed slightly faster growth on maize plants grown in a balanced nutrient solution than on plants subjected to deficiencies of nitrogen, potassium or potassium and phosphorus, and in a field test, in which the plants were infested manually, the percentage survival was higher on vigorous plants than on small, nutrient-deficient ones of the same age.

Martorell (L. F.) & Adsuar (J.). **Insects associated with Papaya Virus Diseases in the Antilles and Florida.**—*J. econ. Ent.* **45** no. 5 pp. 863–869, 34 refs. Menasha, Wis., 1952.

The authors review reports of virus diseases of papaya in the West Indies and the results of investigations on them in Porto Rico [*cf. R.A.E.*, A **37** 33, etc.]. Those that occur in the latter island are bunchy-top and papaya mosaic, the die-back previously recorded [**37** 33] having been found to be only a highly virulent form of bunchy-top. The only known vector of bunchy-top is *Empoasca papayae* Oman, which is apparently restricted to papaya and is the only Jassid that breeds on it in Porto Rico, though others have been found on weeds and grasses beneath the trees. Papaya mosaic has been shown to be transmitted by *Aphis spiraecola* Patch [**37** 33] and also in preliminary tests in Porto Rico by *Carolinaia cyperi* Ainslie, *Myzus persicae* (Sulz.) and *Toxoptera aurantii* (Boy.).

In surveys for the occurrence of these diseases in other parts of the Caribbean area, bunchy-top was found in the Dominican Republic, Haiti, Jamaica and Cuba, in all of which *E. papayae* was present on the trees, being accompanied in Cuba by *E. dilitara* DeL. & Dav. This Jassid also occurs in Porto Rico, though not on papaya, and in some of the other islands. Mosaic was found in

Cuba and also in Florida, where *A. spiraecola, A. gossypii* Glov. and *Rhopalosiphum prunifoliae* (Fitch) were common on papaya. The symptoms were similar in all the areas studied, but it was not known whether they were caused by the same virus. No diseases were found in Vieques Island or in St. Thomas and St. Croix (Virgin Islands). Notes on Hemiptera collected on the trees in all these areas are included.

Spear (P. J.) & Sweetman (H. L.). **Continuous Vaporization of Insecticides with special Reference to DDT.**—*J. econ. Ent.* **45** no. 5 pp. 869–873, 1 graph, 7 refs. Menasha, Wis., 1952.

Continuous vaporisation of DDT or other insecticides by heat provides an effective method of controlling various insects in enclosed spaces such as houses, restaurants, animal quarters or stores [*cf. R.A.E.*, A **40** 85, 122 ; B **39** 139 ; **40** 43 ; **41** 42]. The method, which has been under investigation at the University of Massachusetts since 1947, is rapidly effective against house-flies [*Musca domestica* L.] and mosquitos, but also serves to prevent, or gradually eradicate, infestation by such pests as silverfish, cockroaches or carpet beetles. It involves no disruption of activities in the room treated, no diluent is employed, so that the stains and odours common after spray applications and the dust deposits from dry applications are eliminated, the odour is negligible if the insecticides are properly chosen and used, and the process is economical in both material and labour, but skill and experience are required in choosing a position for the vaporising apparatus, the breakdown of insecticides due to accidental introduction of contaminants may result in bad odours and loss of insecticidal activity, vaporisers are subject to mechanical defects, insecticides of high purity are required, and accurate control of rates of vaporisation must be maintained under diverse physical conditions. Thus well designed vaporisers equipped with thermostats of high quality are required. Some of those produced commercially are briefly discussed.

The accepted rate of vaporisation of insecticides in the United States is 1 gm. per 15,000–25,000 cu. ft. per day. DDT is not at present widely employed in vaporisers used for house-fly control, because of the occurrence of strains of the fly resistant to it, but it readily controls other household pests and those that infest stored products. Owing to the low vapour pressure of p,p'DDT, little remains in the vaporised state at room temperatures, and when it is vaporised by heat at 1 gm. per 20,000 cu. ft. per day, it condenses into droplets, most of which are less than 12 microns in diameter, as soon as it leaves the vaporiser and reaches the cooler air. These droplets persist for up to 4–5 days and then form fine needle-like crystals that remain for several months before subliming. An inhibitor of breakdown is required when DDT is subjected to heat for long periods of time, as in vaporisation. The aerosol formed by the vaporisation of DDT diffuses rapidly. Tests with house-flies indicated that its concentration is initially greater in the upper part of the enclosed still air, but that after some time, it becomes greater in the lower part ; all or nearly all the DDT deposited as a residue from the aerosol falls from still air on to horizontal surfaces. However, under normal conditions of ventilation, the droplets remain airborne for long periods, and probably only a small proportion finally settles on the floor.

A method of suspending house-flies from threads so that they could be exposed to an airborne insecticide but could not come in contact with any surface deposit was devised during the investigation. Nylon thread was used, as its tip could be fused in a flame to make a tiny ball. The ball was coated with melted beeswax and placed against the protergum of an anaesthetised fly.

The fly was not apparently injured, and when suspended could fly in circles but could not lift enough thread to touch any surface.

GERHARDT (P. D.) & LINDGREN (D. L.). **Dictyospermum Scale in California.**—*J. econ. Ent.* **45** no. 5 pp. 874–877, 16 refs. Menasha, Wis., 1952.

Of 49 samples of Coccids submitted for routine determination from Ventura County, California, in 1950, eight from the Santa Paula area and one from the Ventura area (all taken on *Citrus*) proved to be *Chrysomphalus dictyospermi* (Morg.) [*cf. R.A.E.*, A **32** 114], indicating that this species, which already occurs in some commercial plantings of avocado in California, might become a pest of *Citrus*, especially in the coastal areas, if not controlled. Laboratory tests showed that the scales were oviparous and reproduced parthenogenetically, unlike the strain reported from New Orleans [*cf.* **21** 472], and that the duration of the life-cycle averaged 44 days at 78°F. and 86 per cent. relative humidity. No males were observed. When batches 1–50 days old of *C. dictyospermi* from the Santa Paula area and strains of the California red scale [*Aonidiella aurantii* (Mask.)] resistant and non-resistant to hydrocyanic acid gas were fumigated with HCN at 1–4 ml. per 100 cu. ft. for 45 minutes, the mortalities of *C. dictyospermi* resembled those of the non-resistant *A. aurantii*, and it is concluded that *C. dictyospermi* from this area may be considered non-resistant to HCN.

APPLE (J. W.). **Corn Borer Development and Control on Canning Corn in Relation to Temperature Accumulation.**—*J. econ. Ent.* **45** no. 5 pp. 877–879, 1 fig., 3 refs. Menasha, Wis., 1952.

Recommendations for treatments against *Pyrausta nubilalis* (Hb.) on sweet maize grown for canning in the Middle West of the United States are based on the amount of egg-mass deposition and early leaf feeding, and unsatisfactory control is often due to mistakes in the timing of egg-mass counts. Attempts were therefore made to establish temperature accumulations that would indicate the seasonal development of the borer. Many growers use accumulations of degrees above 50°F. in the daily mean temperatures to determine planting and harvesting dates, and a comparison of such accumulations with the appearance of the various stages of *P. nubilalis* in several successive years showed marked agreement and prompted the collection of additional data.

Observations made in north-central Illinois in 1946–48 and in south-central Wisconsin in 1949–51 showed that the temperature accumulations above 50°F. (borer degree-days) at the time of appearance of the first pupae and adults of the overwintering generation, first-generation eggs, larvae, pupae and adults and second-generation eggs and larvae did not differ from those expected by more than 79°F. in most cases, and in central Iowa in 1949–51, the differences between the predicted and actual dates of the first appearance of the various stages were three days or less in 74 per cent. of the comparisons and one day or less in 48 per cent. The season was abnormally early in 1949, and temperatures were above normal during the spring but below normal and normal, respectively, later in 1950 and 1951. By plotting the temperature accumulations, the development of the borer and consequently the best time to make egg-counts and apply insecticides can be estimated. When the population is not unusually high, treatments against the first generation are most effective when applied late in the egg-hatching period, and it is suggested that the need for treatment should be determined at 1,000 borer degree-days (50 per cent. hatch). If treatment is to be based on the proportion of plants showing leaf feeding, this should be determined at 1,100 borer degree-days. It is also necessary to classify the

maturity of the plants before the need for treatment can be decided, and this should be done by means of the tassel-ratio index [*R.A.E.*, A **40** 229].

DITMAN (L. P.) & BURKHARDT (G.). **Further Experiments on Pea Aphid Control.**—*J. econ. Ent.* **45** no. 5 pp. 880–881, 1 ref. Menasha, Wis., 1952.

The experiments described were carried out in the field in Maryland to determine the relative toxicity of several insecticidal dusts and low-volume sprays to the pea Aphid [*Macrosiphum pisum* (Harris)], the effect of seed treatment and subsequent spraying in eliminating mosaic disease from the pea crop, and the effects of the treatments on plant stand and yield of shelled peas. Spray booms designed for applying the low-volume sprays are described.

The peas were sown on 1st April and harvested on 20th June, and Aphid populations were estimated by sweeping on 25th May. The numbers taken per sweep were 682·5 on the control plots, 35 after treatment of the seed a fortnight before sowing with 8 oz. schradan per bushel and enough water to wet the seed thoroughly, and 23 after this treatment followed by two applications of a 30 per cent. DDT emulsion concentrate at 1 U.S. pint in 30 U.S. gals. water per acre. The latter treatment was intended to give the greatest possible reduction in the Aphid population, but it failed to protect the crop from mosaic. Both treatments reduced the plant stand by nearly 30 per cent. Dusts and sprays were applied without seed treatment on 17th May, and the numbers of Aphids per sweep were 111·3 and 252 for dusts of 1 per cent. parathion or DDT, respectively, at 40 lb. per acre, 92·8 for the DDT emulsion spray, and 36·6 for a spray of 50 per cent. malathon emulsion concentrate at 24 fl. oz. in 30 U.S. gals. water per acre. The least significant difference at the 1 per cent. level was 32·9. The yields from all treatments were greater than from the controls, but the increases were not significant.

SINCLAIR (W. B.) & CRANDALL (P. R.). **Methods for determining Ethylene Chlorobromide and Ethylene Dibromide.**— *J. econ. Ent.* **45** no. 5 pp. 882–887, 3 figs., 4 refs. Menasha, Wis., 1952.

Since ethylene chlorobromide showed promise as a fumigant against the oriental fruit-fly [*Dacus ferrugineus dorsalis* Hendel], investigations were carried out to ascertain whether the method of determination by reaction with monoethanolamine developed for ethylene dibromide [*R.A.E.*, A **40** 172] was applicable to it and also whether it could be applied to both fumigants as residues in *Citrus* pulp and peel. The methods used are described in detail. The results showed that monoethanolamine completely hydrolised both liquid and gaseous ethylene chlorobromide when heated with it for one hour at 100°C. When the mixture of ethylene chlorobromide and monoethanolamine was diluted with water, the period of heating required for complete hydrolysis increased with the degree of dilution. The presence of macerated orange peel and pulp did not prevent complete hydrolysis of ethylene dibromide or ethylene chlorobromide when heated with monoethanolamine at 100°C. for one and two hours, respectively.

CHANDLER (S. C.). **Life History and Control of Pecan Spittlebug in Illinois.**— *J. econ. Ent.* **45** no. 5 p. 890, 1 ref. Menasha, Wis., 1952.

The pecan spittlebug has been referred to in the economic literature of the United States over the past 25 years as *Clastoptera obtusa* (Say) [*cf. R.A.E.*, A **13** 566], but may have been misidentified, since a Cercopid that has become a serious pest of this tree in Illinois was determined as *C. achatina* Germ. by K. Doering, who stated that *C. obtusa* infests hickory and that the two species

are readily differentiated. *C. achatina* occurs on pecan throughout Illinois and appears to have two generations a year, the newly hatched nymphs appearing about 1st June and 10th July. In cage studies, adults emerged throughout August and oviposited in small slits in the bark soon after emergence, several eggs being deposited in each slit. In an orchard inspected in 1951, 90–98 per cent. of all terminals were infested. The most obvious injury was the killing of shoots that would have produced fruit buds. In preliminary tests, the Cercopid was readily controlled by spraying to the point of run-off with 1 lb. 25 per cent. wettable γ BHC as lindane per 100 U.S. gals. Only fair control was given by 1·5 lb. 15 per cent. wettable parathion per 100 U.S. gals., and 0·33 pint 40 per cent. tetraethyl pyrophosphate per 100 gals. gave poor results.

Snapp (O. I.). **Injury to Peach Trees from Propylene Dichloride.**—*J. econ. Ent.* **45** no. 5 p. 890. Menasha, Wis., 1952.

The author reports that propylene-dichloride emulsion, which has been used for the control of the peach-tree borer [*Aegeria exitiosa* Say] in Georgia for 11 years [*cf. R.A.E.*, A **34** 336, etc.], damaged peach trees there in 1950 for the first time when used at the recommended rate. Propylene-dichloride and ethylene-dichloride emulsions were applied in the autumn, a few days after 2·37 ins. rain had fallen, in four orchards, and the former caused severe injury to the cambium on 2–6 trees in two orchards, moderate injury on 2–15 in three orchards and light injury on 2–18 in all four. No injury was caused by ethylene dichloride, and untreated trees were not affected. Such damage is considered to be associated with water-logged soil, though extremely low temperatures a month after application may have been a contributing factor. The recommendation of propylene-dichloride emulsion for the control of *A. exitiosa* in Georgia is withdrawn.

Bohart (G. E.). **Yearly Population Fluctuation of *Bombus morrisoni* at Fredonia, Arizona.**—*J. econ. Ent.* **45** no. 5 pp. 890–891. Menasha, Wis., 1952.

Bombus morrisoni Cress. is one of the most important native pollinators of lucerne in many intermountain localities in Arizona and Utah, and the author gives data from several localities on the borders of these States showing that the numbers of this bumble bee varied widely in the years 1948–51. Wild flowers are normally sufficiently common in April and May to provide enough forage for the overwintered queens during the period of nest founding, but in the particularly dry cold spring of 1950 there were practically none in one district, and few bumble bees were seen throughout the summer. Honey bees were introduced to pollinate the lucerne, but insufficient were available and seed yields were very low. It seems likely that if small areas of irrigated spring forage, such as vetch, had been provided in 1950, there would have been a much greater survival of queens and increase of colonies, and it would probably be advisable for growers of any crop pollinated by bees to ensure a succession of bloom in the area throughout the growing season.

Flanders (S. E.). **A Method for transferring Infestations of Purple Scale.**—*J. econ. Ent.* **45** no. 5 p. 891, 3 refs. Menasha, Wis., 1952.

Investigations in California have shown that the most suitable medium for the laboratory propagation of *Lepidosaphes beckii* (Newm.) is the mature fruit of the citron melon (*Citrullus* sp.), and the author describes a method of securing infestation that is suitable for use with any Coccid that deposits most of its eggs before hatching begins and that cannot be collected phototropically

in the crawler stage. Egg-filled scale covers are scraped from infested plants into small bags, made of material so closely woven that only the newly hatched crawlers can pass through it, and these are placed flat on the upper surfaces of the melons with the scale covers distributed evenly in them. The bags are left for one or more days, after which the melons are turned and the bags moved to new positions. This is continued until the entire surface is infested. The crawlers move downwards through the cloth and attach themselves to the melon, settling most readily where the bag is in contact with the fruit.

The female contracts as it oviposits, and few, if any, eggs hatch until oviposition is completed. The scale cover becomes completely filled with eggs about ten days after the beginning of oviposition. In order to secure uniformity in development, the humidity should be at least 55 per cent. The scales begin to oviposit about 45 days after settling, and produce 60–80 eggs each. At 80°F., the hatching of the full complement is completed in about ten days.

Furr (R. E.) & Calhoun (S. L.). **Toxicity of organic Insecticides to the Fall Armyworm.**—*J. econ. Ent.* **45** no. 5 p. 892, 4 refs. Menasha, Wis., 1952.

One of the heaviest infestations by *Laphygma frugiperda* (S. & A.) known in recent years occurred in the Mississippi Delta in the autumn of 1951. Serious damage was done to young oats, wheat and permanent pastures, and also to cotton in localised areas earlier in the season ; control measures were required in several places. In a test in a field of self-sown oats and grasses with an average of 22·8 larvae per sq. ft., some of the new organic insecticides were applied in emulsion sprays on 11th October, when 51 per cent. of the larvae were in the third instar and 38 per cent. in the fourth, and mortality was recorded after 24 hours. The temperature was 38–77°F. and the relative humidity 30–100 per cent. during this period. When applied in 3 U.S. gals. spray per acre, Compound 269 (a stereoisomer of dieldrin [recently named endrin]) at 0·2 lb. per acre and toxaphene at 2 lb. per acre gave 92 per cent. mortality, and 0·25 lb. aldrin, 0·4 lb. γ BHC, 0·5 lb. DDT, heptachlor or DDD (TDE), 0·3 lb. EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] and 0·15 lb. dieldrin per acre more than 75 per cent. Tetraethyl pyrophosphate and Compound 711 (a stereoisomer of aldrin [recently named isodrin]) were rather ineffective.

Hopkins (L.), Gyrisco (G. G.) & Norton (L. B.). **Trials with Lime in controlling DDT Residues on Forage at Harvest.**—*J. econ. Ent.* **45** no. 5 pp. 893–894, 3 refs. Menasha, Wis., 1952.

As alkaline materials have been shown to cause dehydrochlorination of DDT even under normal conditions [*cf. R.A.E.*, A **37** 393], tests were made to determine whether the inclusion of lime in a DDT dust would accelerate degradation of residues in the field to such an extent that applications could safely be made near harvest without seriously affecting the immediate insecticidal action.

Forage crops of lucerne and brome grass [*Bromus*], on which residues at harvest are particularly undesirable, were dusted with 5 per cent. DDT in pyrophyllite, in high-calcium lime or in mixtures giving 10–95 per cent. lime in the final dust in 1949 and 25–95 per cent. in 1950. Technical DDT was used in 1949 and technical and aerosol grades in 1950. Insect counts were made 2–14 days after treatment, and hay samples were analysed for residues at intervals. The results showed that although in the first few days after application there may have been a speedier loss of DDT from freshly mixed DDT and lime, the residues after two weeks from DDT without lime were no

greater than those from mixtures containing up to 50 per cent. lime and not significantly greater than from those containing 50 per cent. or more lime. It is likely that, under field conditions, the lime combines with atmospheric carbon dioxide too rapidly to undergo extensive reaction with DDT. The lime did not affect the toxicity of the DDT to insects or reduce its period of effectiveness. There was no significant difference in persistence between technical and purified DDT.

STEINHAUS (E. A.). **The Susceptibility of two Species of *Colias* to the same Virus.**—*J. econ. Ent.* **45** no. 5 pp. 897–899, 7 refs. Menasha, Wis., 1952.

Most of the viruses that attack insects show pronounced host-specificity, but some instances of attack on more than one host species have been recorded. In this paper, the author reports that larvae of *Pieris rapae* (L.) were infected in the laboratory with *Borrelina campeoles* of Steinhaus, a virus causing polyhedrosis of *Colias eurytheme* Boisd. in the United States [*cf. R.A.E.*, A **40** 62], and the latter species with one from *P. rapae*, but *P. rapae* was not attacked by the polyhedrosis viruses known to infect *Laphygma exigua* (Hb.), *Prodenia praefica* Grote and *Phryganidia californica* Pack., and *Laphygma* and *Phryganidia* larvae did not become infected by the virus from *P. rapae*. In two tests with a virus that causes polyhedrosis in *Colias lesbia* (F.) in Argentina, 21 of 25 and 31 of 32 larvae of *C. eurytheme* died after feeding on lucerne dipped in an aqueous suspension of dead infected larvae of *C. lesbia*, and in another, larvae of *C. eurytheme* that fed on food dipped in a suspension of the Argentine virus or of *B. campeoles* all died of polyhedrosis ; no infection appeared in the controls. Larvae of *C. eurytheme* are thus susceptible to a polyhedrosis virus occurring in *C. lesbia*, although the two species belong to different groups. It is probable that the Argentine virus is *B. campeoles*, but this has not been proved.

WILBUR (D. A.). **Effects of insecticidal Dusts containing Piperonyl Butoxide and Pyrethrins applied to Wheat on the Flavor of Eggs.**—*J. econ. Ent.* **45** no. 5 p. 899. Menasha, Wis., 1952.

In laboratory and field studies in which dusts containing piperonyl butoxide and pyrethrins were applied to wheat to protect it from insect damage, a mild odour was imparted to the grain and persisted for several days. As flavours and odours from the food consumed by hens are rapidly imparted to their eggs a proprietary dust of 0·8 per cent. piperonyl butoxide and 0·05 per cent. pyrethrins impregnated in pulverised wheat was mixed with wheat at the rate of 4 lb. per 10 bushels (four times the recommended rate), and the treated grain fed to laying hens at the rate of about 0·1 lb. per bird, with the same amount of mash, every morning from 14th to 21st April 1951. The hens took the food readily and showed no significant change in egg-production. The eggs laid, up to a maximum of twelve, were collected on 17th, 19th and 21st April and kept in cold storage until the end of the feeding period. On 23rd April, the eggs were boiled hard and sampled while hot ; no foreign odour or taste could be detected.

COX (J. A.). **How Growth and Yield of Concord Grapes are affected by DDT-Bordeaux Mixes.**—*Agric. Chem.* **8** no. 3 pp. 37–39, 151, 153, 155, 5 figs., 6 refs. Baltimore, Md., 1953.

In the Erie grape belt of the United States, satisfactory control of severe infestation by *Polychrosis viteana* (Clem.) requires three applications of DDT, at

the rate of 12–16 oz. per 100 U.S. gals., though light infestation can be controlled by one application against the first generation and one against the second [*cf. R.A.E.*, A **38** 246 ; **40** 174]. *Erythroneura comes* (Say) can be controlled with one application of DDT at 4 oz. per 100 U.S. gals., which appears to kill both adults and nymphs and is equally effective before and after flowering.

During 1950, the standard spray programme of DDT and bordeaux mixture caused pronounced foliage injury to Concord grapes, whereas DDT and ferbam [ferric dimethyldithiocarbamate] caused little or none, and in 1951 and 1952 experiments were carried out in Pennsylvania on the occurrence and extent of such damage. Sprays of bordeaux mixture (4 : 4 : 100) with a spreader or of 1·5 lb. 50 per cent. wettable DDT per 100 U.S. gals. with a spreader, alone or with bordeaux mixture, 1·5 lb. ferbam or 3 lb. each of 26 per cent. tribasic copper sulphate and lime, were applied at 200–225 U.S. gals. per acre after the berries had set, ten days later and in late July or early August. In 1951, plots receiving three applications of bordeaux mixture alone or with DDT yielded less fruit per acre than those receiving the other sprays, but the differences were not significant. In 1952, treatment with bordeaux mixture alone or with DDT reduced vegetative growth by 25 and 34 per cent., respectively, and resulted in low yields of grapes (3·5 and 2·7 tons per acre), with small berries and clusters and few clusters per vine. The difference between these yields was significant. Treatment with DDT and ferbam resulted in the greatest vegetative growth and the highest yield (4·3 tons). Neither one late spray of DDT and bordeaux mixture after two of DDT and ferbam nor three of DDT alone or with tribasic copper sulphate and lime reduced growth or yield significantly.

Stickney (F. S.), Barnes (D. F.) & Simmons (P.). **Date Palm Insects in the United States.**—*Circ. U.S. Dep. Agric.* no. 846, 57 pp., 16 figs., 68 refs. Washington, D.C., 1950.

This review of information on the pests of date palms and developing and stored dates in the United States is based mainly on investigations in California and Arizona in 1921–36 and from 1945 onwards. Details are given of the appearance of the various stages, life-history, food-plants, distribution and natural enemies of the more important, with descriptions of the injury they cause and methods of control, and there are shorter accounts of those of less importance.

Parlatoria blanchardii (Targ.), which was formerly very destructive to the palms, was apparently eradicated in 1936 [*cf. R.A.E.*, A **30** 362, etc.], and *Phoenicococcus marlatti* Ckll., which is common, appears to do little damage [*cf. loc. cit.*]. *Paratetranychus simplex* (Banks) [*cf.* **28** 415] infests the leaves and also the fruits from the time of their formation until they begin to ripen, covering them with a mass of webbing. Colonies develop rapidly and sometimes cause serious injury in 2–3 weeks, and all stages are present throughout the year, though activity is reduced in winter. Dusting the bunches with fine sulphur as soon as the colonies appear, in May or early June, gives good control without scorching if the fruits are healthy and protected from the sun by foliage. *Scolothrips sexmaculatus* (Perg.), a species of *Stethorus* and a Eupodid mite feed on *P. simplex*, but do not control it. The mite is generally distributed in the four chief date-growing areas ; heavy infestations develop in the Coachella and Imperial valleys, in California, and in the Yuma Valley, in Arizona, but have not been observed in the Salt River Valley, Arizona. *Asarcopus palmarum* Horv. feeds on the white tissue behind the fibre, between unexpanded parts of terminal leaves and within the spathes on the white tissue of the current season's fruit stalks. It does not much affect healthy plants, but may so injure small weak ones that the terminal leaves droop. In tests, opening the basal part of the

leaves in June–July, when this Issid is most active, and applying a dust containing 3·5 per cent. nicotine in sulphur gave satisfactory control for the season ; spraying with nicotine sulphate (1 : 500) gave rapid but only temporary control.

The Cetoniid, *Cotinis texana* Csy., is injurious in the Salt River Valley, where the adults feed on the ripe and fermenting fruits. The larvae develop in organic litter, and can be controlled by clearing corrals, manure heaps and haystack residues in February–April or by flooding infested areas for 48 hours. Nitidulids have recently increased greatly in date plantations, where the adults and larvae feed on dates that are ripe or in early stages of decay. The most important are *Carpophilus* (*Urophorus*) *humeralis* (F.), *C. hemipterus* (L.), *C. dimidiatus* (F.) and *Haptoncus luteolus* (Erichs.), and these are the most destructive of all the insects that attack dates. Ripe fallen fruits are heavily infested, and larvae that develop in them enter the soil to pupate. The collection of such fruits is therefore an important measure of control, but destruction of breeding material over a wide area would be necessary for adequate protection. Most of the insects in the soil are within 8 ins. of the surface and within 6 ft. of the palm trunks, and flooding for 6–8 days kills practically all the larvae and pupae. In tests, dusting the fruits with sulphur containing 5 per cent. ferbam (ferric dimethyldithiocarbamate) reduced injury due to Nitidulids and fungi, and covering the bunches with paper and cloth was promising.

The fruits are attacked by larvae of *Ephestia figulilella* Gregson and *Plodia interpunctella* (Hb.) in California and by the former in Arizona. *Ephestia* is mainly a field pest and breeds little in the stored dates, whereas *Plodia* occurs mainly in the latter and is of little importance in the field. Both are parasitised by *Bracon* (*Microbracon*) *hebetor* Say. *Oryzaephilus surinamensis* (L.), which is parasitised by *Cephalonomia tarsalis* (Ashm.), attacks dates that have been in store for some time.

Minor pests that injure the palms include the Cicadid, *Diceroprocta apache* (Davis), the oviposition punctures of which obstruct the passage of sap to the fruits when they occur in the fruit threads, *Dinapate wrighti* Horn, larvae of which tunnel in the growing tips, and *Strategus julianus* Burm., adults of which bore into the trunks from the soil and sometimes kill small palms. Those that attack the fruits on the trees or on the ground include *Myelois venipars* Dyar, *Coccotrypes dactyliperda* (F.) [*cf.* **32** 210], *Typhaea stercorea* (L.), and *Leptoglossus zonatus* (Dall.), and stored dates are sometimes infested by *Tyrophagus lintneri* (Osborn), *Tinea* (*Nemapogon*) *granella* (L.), and *Laemophloeus ferrugineus* (Steph.). Stored dates can be freed from most insects by fumigation with methyl bromide [*cf.* **35** 324] and protected from infestation by storing at temperatures of 32°F. or less.

Tenhet (J. N.) & Bare (C. O.). **Control of Insects in stored and manufactured Tobacco.**—*Circ. U.S. Dep. Agric.* no. 869, 32 pp., 20 figs., 11 refs. Washington, D.C., 1951.

This circular is similar in scope and contents to one already noticed [*R.A.E.*, A **31** 116], which it supersedes, but contains additional information on methods of preventing and controlling infestation by insects in stored and manufactured tobacco in the United States. Infestation by *Ephestia elutella* (Hb.) on the farm can be reduced or prevented by thoroughly cleaning empty storehouses and spraying the walls and ceilings with 5 per cent. DDT in early spring. If infestation develops and it is necessary to store the tobacco for more than 2–3 weeks, the air space should be sprayed with 0·2 per cent. pyrethrins in light volatile oil, applied thoroughly as a mist, once or twice a week. Covering the tobacco with plant-bed cloth free from holes gives some protection ; the cloth should be removed every 4–5 days in warm weather and put in boiling water to destroy eggs.

In open warehouses, the screening of openings and the use of suction light-traps are recommended against *E. elutella* and *Lasioderma serricorne* (F.) [*cf. loc. cit.*] ; weekly applications of pyrethrum in oil against the adults should be begun when weekly trap catches reach ten examples of either species and continued until lower temperatures in autumn check insect activity. The spray should be applied at about 3 fl. oz. per 1,000 cu. ft. of unoccupied space and should contain 0·2 per cent. pyrethrins against *Ephestia* and 1 per cent against *Lasioderma*. In closed warehouses, pyrethrum in oil is still more effective than in open premises and has sometimes given satisfactory control of both species, but as it does not kill the immature stages in the tobacco, it cannot replace fumigation against an established infestation. The recommended fumigation treatment is exposure to hydrocyanic acid gas at 16 oz. per 1,000 cu. ft. for 72 hours, and the temperature of the tobacco should be at least 70°F. The dose should be increased to 20 oz. where much leakage is expected, and 3–4 treatments with 8–12 oz. HCN per 1,000 cu. ft. for 24–48 hours at intervals of 20–45 days are often advantageous. Satisfactory results are given in specially constructed chambers at atmospheric pressure by fumigation at not less than 70°F. with HCN at 16–24 oz. per 1,000 cu. ft. for 72 hours, with 32–40 oz. of a mixture of acrylonitrile and carbon tetrachloride for 72 hours for flue-cured tobacco in hogsheads, or with 32 oz. of the mixture for 48 hours for bales of Turkish tobacco or bales or cases of cigar-filler or binder tobacco. In vacuum chambers, HCN, a mixture of ethylene oxide and carbon dioxide (1 : 9) and a mixture of acrylonitrile and carbon tetrachloride (1 : 1) are effective at 4–5, 45–65 and 4 lb. per 1,000 cu. ft., respectively, at a temperature of 70°F. [*cf. loc. cit.*]. Exposure of infested tobacco to high vacuum alone for three and ten days was found to control all stages of *Ephestia* and *Lasioderma*, respectively [*cf.* **37** 348].

A suggested programme for insect control in tobacco warehouses involves operating suction light-traps from a time before the earliest spring emergence of adults, spraying with pyrethrum in oil as indicated by the catches, and fumigating soon after the peak of emergence if the sprays fail to give control ; if sprays are not used, fumigation should be repeated 2–4 times a year.

Lawson (F. R.), Chamberlin (J. C.) & York (G. T.). **Dissemination of the Beet Leafhopper in California.**—*Tech. Bull. U.S. Dep. Agric.* no. 1030, 59 pp., 13 figs., 37 refs. Washington, D.C., 1951.

The following is substantially the authors' summary of studies on the movements of *Circulifer tenellus* (Baker), the vector of the curly-top virus of sugar-beet, in the San Joaquin Valley of California in 1935–37. *C. tenellus* uses two sets of seasonal food-plants, of which the summer ones are usually located in the valley itself [*R.A.E.*, A **32** 31] and the winter and spring ones on the western foothills or on the adjacent plains [**18** 374]. Major movements from one set of food-plants to the other occur in spring and again in autumn, with minor movements at other times of the year. Dissemination was found to be by flight. Major flights were associated with the maturity of the insects and the drying of the food-plants over large areas, and the adults concerned consisted largely of unparasitised and non-gravid individuals.

When temperatures exceeded a somewhat variable minimum, usually 60–64°F., large numbers of adults took to the air in the crepuscular periods near sunrise and sunset, and most flights occurred at those times of day. If low temperatures during these periods prevented flight, substantial movements sometimes occurred during warmer parts of the day. Evening flights were far commoner than morning flights because temperatures were more often favourable in the evening. If wind velocities were low during the twilight periods of activity, the males were attracted to conspicuous objects and swarmed

round them ; at higher wind velocities, both males and females were carried along in the wind stream. Other factors being equal, the numbers of Jassids that moved on any particular day were proportional to the temperature.

Jassids in flight apparently come to the ground whenever temperature or any other condition becomes unfavourable. Some land on food-plants, but most of them probably come down on other plants or on bare ground. Such insects again take to the air when conditions are favourable, and continue to fly until they find suitable plants or die. Both males and females migrated, but females covered longer distances. In the spring, females tended to accumulate on food-plants, but males continued the flights. In the autumn, both sexes moved more or less continuously. This seasonal difference in the behaviour of the females may be associated with egg development in spring.

The numbers of Jassids in the air decreased with height above the ground, and major flights occurred close to the surface. Jassids in flight moved with the wind and at about the same speed. Thus, movements having a directional character result from a passive drifting with more or less constant winds.

Because of the restrictions imposed on flight by light and temperature, and the tendency for favourable conditions in the San Joaquin Valley to coincide with atypical weather, the routes followed by major flights are likely to be across or against the prevailing winds. Thus, Jassids that develop in spring on the west side of the valley move in large numbers eastward across the valley and at right angles to the prevailing winds, because strong down-canyon winds blow in the evening and morning on warm days. Westward movements toward the coast take place when warm air masses from the valley move through the passes in the coast range. Movements from the coast to the east are largely prevented because winds from the coast are cold. In the autumn, Jassids from summer food-plants in the valley move toward the hills to the west because winds from the valley toward the hills are warmer than those blowing in the opposite direction.

DE ONG (E. R.). **Insect, Fungus and Weed Control.**—8½ × 5 ins., 400 pp., 37 figs., many refs. New York, N.Y., Chemical Publ. Co., Inc., 1953. Price $10.

In this review of recent information on the control of insect and other animal pests, fungi and weeds, almost exclusively by chemical means and with special reference to the United States, preliminary chapters deal with the physical properties of sprays and dusts, recent developments in equipment for their application, and legislation and regulations in the United States regarding the labelling of proprietary products used in pest control. The materials are then considered according to their field of application. Four chapters are devoted to chemicals used in dusts and sprays, principally against insects and mites that attack agricultural crops and fruit trees, classified as inorganic and organic insecticides, mineral, vegetable and animal oils, and plant derivatives. Other chapters contain information on fumigants for the treatment of growing crops or of the soil, chemicals used for seed protection, and materials used on an industrial scale for insect control in warehouses, mills and other premises, as moth-proofing agents and as timber preservatives. There is also a chapter on insect pests and diseases of forest trees and their control, and another including information on the control of insects that attack fabrics or cause annoyance in houses. In each case a general account of the principles involved in the method of application or of the properties of the compounds under consideration is given, followed by information on the chemical properties and uses of the individual materials, with specific recommendations. Some results of research published in 1950–52 after the completion of the main text are given in an appendix.

MERTIN (J. V.). **Pesticides : a Review of their Uses, Properties and Hazards.**—[2 +] 123 pp., refs., multigraph. Adelaide, Dep. Hlth. Aust., 1951. **Pesticides Quarterly Supplement no. 1, February 1952.**—pp. 124–138, 1 fig., 20 refs. **No. 2, May 1952.**—pp. 139–174, 1 graph, 70 refs. **No. 3, August 1952.**—pp. 175–223, 76 refs. **No. 4, November 1952.**—pp. 224–262, 81 refs.

This review collates information on the hazards to human health associated with materials used in pest control that was hitherto scattered throughout the industrial and agricultural, medical and other scientific literature, mainly that published in the British Commonwealth and the United States during 1945–51. It is based on nearly 800 papers and monographs. It comprises five chapters followed by a glossary of medical terms, the bibliography and an index. The first chapter deals with such subjects as general hazards and precautions, relative toxicities, and administrative measures for safeguarding health that have been adopted or recommended in various countries, and the second (pp. 19–84) with insecticides. These are classified primarily according to whether they were or were not in general use prior to 1939, and information is given on their chemical properties, uses in pest control and symptomatology and toxicology in man, and on methods of treatment in cases of poisoning and precautionary measures. The remaining chapters contain similar data on fungicides and materials used to destroy weeds and rodents.

The supplements are the first four of a series that is to be issued quarterly to keep the information up to date. Their arrangement resembles that of the main review, and they are paged in sequence from it to facilitate the use of the yearly index that is to be provided.

FULLAWAY (D. T.). **Review of the Indo-Australasian Parasites of the Fruit Flies (Tephritidae).**—*Proc. Hawaii. ent. Soc.* **14** no. 2 pp. 243–250. Honolulu, 1951.

The author gives lists of the Opiine parasites of fruit-flies collected from the Indo-Australian region in connection with investigations on the control of *Dacus ferrugineus dorsalis* Hend. in Hawaii. He divides them into three groups on characters peculiar to the representative species, *Opius longicaudatus* (Ashm.), *O. persulcatus* (Silv.) and *O. fletcheri* Silv., and describes two new species in each. These include *O. kraussii*, sp. n. [*R.A.E.*, A **40** 173], which was reared from fruit-fly pupae collected on *Planchonella* in Australia, *O. watersi*, sp. n. [**40** 173, 236], from fruit-fly puparia on *Luffa* in the United Provinces, India, and *O. oophilus*, sp. n. [**40** 83, 173, 236] from *D.f. dorsalis* in Hawaii. The last is believed to have been introduced from Malaya and is also recorded from North Borneo, Siam, India and Formosa.

NEWELL (I. M.), VAN DEN BOSCH (R.) & HARAMOTO (F. H.). **An improved Method of rearing field-collected Fruit Fly Larvae.**—*Proc. Hawaii. ent. Soc.* **14** no. 2 pp. 297–299, 1 fig. Honolulu, 1951.

The relatively low and variable rate of survival of fruit-fly larvae in field-infested fruits in the insectary in Hawaii made it desirable to develop a rearing technique that would give more consistent and higher rates of survival and emergence of both fruit-flies and parasites. A method is described that has been used for more than a year and has resulted in 76 per cent. survival of *Dacus ferrugineus dorsalis* Hend. and 85 per cent. of *D. cucurbitae* Coq. to the adult stage. It involves removing the larvae from the fruits and transferring them to dishes containing a rearing medium. Blended papaya pulp with a small quantity of yeast is used for *D. f. dorsalis*, and small pieces of pumpkin or squash for *D.*

cucurbitae. The dishes are kept in rearing jars specially prepared to maintain optimum humidity and stored at a temperature of 28°C. [82·4°F.] until flies or parasites emerge. Detailed instructions are given for preparing the rearing jars, which have a fungicide at the bottom, a plaster floor covered with sand part of the way up, and a wire stand for the rearing dish, and the results obtained by this method are compared with those from rearing the larvae in the fruits in funnels, to drain off excess juice, or in boxes. The main disadvantage of the new method is the work involved in transferring the larvae from the fruits to the rearing medium, but it has the advantages of space conservation, ease of handling, elimination of harmful and competing organisms and control of humidity, and results in higher larval survival and higher and more uniform emergence from the puparia, more rapid and uniform rates of development of the flies and parasites and a reduction of obnoxious odours and of *Drosophila* in the insectary.

Bhatia (B. M.). **Borers of Sal Poles and their Control.**—*Indian For. Rec.* (N.S.) Ent. **8** no. 4 pp. 17–34. Dehra Dun, 1950.

During the late war, many poles of *Shorea robusta*, felled for military purposes in India, became seriously damaged by borers, and the effect of simple protective measures was tested in 1946–48. Poles felled during and after the monsoon, in winter and in summer in Orissa (June, September, December and March) and the United Provinces (July, October, December and April) were kept in forest shade or in full sunlight and barked immediately or after 1–5 months. They were kept under observation for up to 18 months, and details are given of the degrees to which they were attacked by Coleopterous borers. Bostrychids, Cerambycids, Platypodids and Scolytids caused most of the damage, and Anthribids and Curculionids were of little importance. Lists are given of the numerous species concerned in each locality, together with notes on the habits of some of them.

The incidence of the species in the poles varied with the time of felling and subsequent management, and it is concluded that in Orissa, poles should be barked after one month and kept in the open sun if felled during the monsoon and in forest shade if felled after it ; barking of poles felled in winter can safely be postponed for two months after felling if they are kept in the shade, and poles felled in summer can be kept with the bark intact for up to two months in the shade and four months or more in the open without much risk of damage. In the United Provinces, poles felled during the rains should be kept in the sun and barked after three months, and those felled after them barked immediately and kept in the shade. In this area, poles felled in winter or summer are liable to be damaged by borers whether kept in sun or shade and whether barked or not.

Chatterjee (N. C.), Bhasin (G. D.) & Bhatia (B. M.). **Insect Borers of *Boswellia serrata* and their Control.**—*Indian For. Rec.* (N.S.) Ent. **8** no. 5 pp. 35–51, 1 pl. Dehra Dun, 1950.

The insects that damage logs and sawn timber of *Boswellia serrata* in the Central Provinces and Berar, India, were investigated in 1941–48 in connection with reports of injury. The work showed that when the newly felled logs are kept in the shade, the bark remains green for several months and they are not readily attacked by borers. As the bark dies, it is invaded by the Scolytids, *Xyleborus similis* Ferrari and *X. testaceus* Wlk., and the Platypodid, *Platypus solidus* Wlk., which do not weaken the timber structurally and are of negligible importance in the Central Provinces ; by the Lamiid, *Batocera rufomaculata* (Deg.), which makes large, irregular and deep excavations in the sapwood

and beyond, and the Cerambycid, *Plocaederus ferrugineus* (L.), which is unimportant, as it bores not more than one inch into the sapwood ; and by the Lymexylonid, *Atractocerus reversus* Wlk., which is the most injurious of all [*cf. R.A.E.*, A **32** 390]. Wood attacked by this borer is riddled with large tunnels ; infestation is usually heavy, and planks cut from the logs are closely perforated by circular or oval holes.

Logs from which the bark has been removed are immune from *A. reversus*, *B. rufomaculata* and *P. ferrugineus*, but are attacked by *X. similis*, *X. testaceus* and *Platypus solidus* while the surface is moist and by Bostrychids when it has dried slightly. Of these, *Sinoxylon anale* Lesne, *Heterobostrychus aequalis* (Waterh.) and *Schistoceros anobioides* (Waterh.), were the main species, but attack by them does not extend beyond a depth of two inches ; *Sinoxylon* was the most injurious. The time taken for planks and scantlings to dry varies with circumstances, and they are liable to attack by the three Bostrychids while they are moist and later by *Lyctus africanus* Lesne. Notes are included on the bionomics of the beetles. *A. reversus* has two generations a year in the Central Provinces, with a minimum life-cycle of three months. Adults emerge in March–October, with a maximum in April and May. Logs of different sizes showed no difference in susceptibility to attack by *A. reversus*, and favourable sites for oviposition resulted where logs were in contact with one another or with other objects or where the bark was ringed for girth measurements.

In a test in which two of four logs felled each month from March to September 1943 were barked and two left with the bark on, and one of each pair was stored in the shade and one in the open exposed to the sun until October 1943, properly barked logs were not attacked by *A. reversus*, and most of those with bark on were, regardless of how they were stored. Attack by *S. anale* occurred in logs felled between March and September and was heaviest in barked logs kept in the shade and negligible in logs with the bark on. Logs felled in March–June or August–September were attacked by *H. aequalis*, and attack was heaviest in those felled during the first period and kept in the shade. *Schistoceros* attacked logs felled in March–May, *Xyleborus* spp. those felled in March–August, attack being fairly heavy on barked logs kept in the sun but negligible on others and mainly confined to the lower surfaces, and *P. solidus* those felled in September only. Attack by *Plocaederus ferrugineus* occurred in logs felled during March–July and kept with the bark on in sun or shade, and attack by *B. rufomaculata* was not recorded though it occurred during logging operations in the forest. A weevil, *Sipalinus* (*Sipalus*) sp., attacked logs felled in March–May or July–August and kept with the bark on, injury being negligible in the shade but appreciable in the open. Cracking of the logs kept in sun or shade was not important.

It is concluded that for maximum protection against borers, logs should be barked immediately after felling, stacked on skids in a single layer and not in contact with one another, and inspected at frequent intervals. Drying should be accelerated by turning, and infested sapwood should be removed. All rejected wood should be cleared from sawyards, and fuel dumps should not be established near them. Unseasoned timber should not be used in building new depots and sawmills.

NESBITT (H. H. J.). **A taxonomic Study of the Phytoseiinae (Family Laelaptidae) predaceous upon Tetranychidae of economic Importance.**—*Zool. Verh.* no. 12, [2+] 64 pp., 32 pls., 1 fig., 35 refs. Leiden, 1951.

This revision of the Phytoseiine Laelaptids was undertaken because of the importance of some of these predacious mites as natural enemies of *Paratetranychus pilosus* (C. & F.) on fruit trees. A history of their classification, notes on morphology and keys to the genera, subgenera and species are given,

as well as the characters and types of the genera ; the individual species are described, or their original descriptions are quoted or translated into English, and records are included of the type habitat of each, its distribution, the trees or other plants on which it has been found and, if known, the mites or insects on which it is predacious. There are four new species and one new variety.

The genera dealt with are *Typhlodromus* (with *Neoseiulus* as a subgenus), *Garmania*, gen. n. (including *Paragarmania*, subgen. n.), *Blattisocius*, *Kampimodromus*, gen. n., and *Phytoseius*, but two others, *Amblyseius* with its subgenus *Amblyseiopsis* [*cf. R.A.E.*, A **38** 270 ; **40** 264] and *Kleemannia* are also included in the key. Reasons are given for regarding *Iphidulus* as a doubtful or unknown genus and discarding it, and for not using *Seiulus* as a genus for mites of the group under consideration, though the particular species that should be considered the genotype is uncertain. *Iphidulus conspicuus* Garman, *I. fallacis* Garman, *I.* (*Seius*) *pomi* (Parrott) and *Seiulus bakeri* Garman [*cf.* **38** 270] are all referred to *Typhlodromus*, *S. bakeri* being included in the subgenus *Neoseiulus*. *T.* (*I.*) *fallacis* is no longer considered a synonym of *T.* (*I.*) *tiliae* Oudm. [*cf.* **38** 271]. *Seiulus spoofi* Oudm. is transferred to *Phytoseius*.

Seven of the species included in the other genera were described in *Typhlodromus* by Oudemans and have been recorded in the latter genus in this *Review*. These are *Garmania domestica*, *G. bulbicola*, *G. pomorum*, *G.* (*Paragarmania*) *mali*, *Kampimodromus heveae*, *K. hevearum* and *Blattisocius tineivorus*. *B. tineivorus*, of which *B. triodons* Keegan, the type of the genus, is a synonym, is predacious on insects that infest stored products and has never been found out of buildings.

COLLYER (E.). **Biology of some predatory Insects and Mites associated with the Fruit Tree Red Spider Mite** (*Metatetranychus ulmi* (**Koch**)) **in south-eastern England. II. Some important Predators of the Mite.**—*J. hort. Sci.* **28** no. 2 pp. 85–97, 2 pls., 5 figs., 30 refs. London, 1953. **III. Further Predators of the Mite.**—*T.c.* pp. 98–113, 8 figs., 40 refs.

In the first of these two parts, the author gives a list of 37 species of insects and four mites found, with unidentified Cecidomyiid and Syrphid larvae and Cheyletid and Bdellid mites, attacking *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) on fruit trees in Essex, and gives notes on the distribution, life-history and feeding habits of those other than *Blepharidopterus angulatus* (Fall.) [*cf. R.A.E.*, A **41** 39] that are abundant in well-kept commercial orchards. They include *Anthocoris nemorum* (L.), examples of which consume 20–50 mites a day, and *Orius majusculus* (Reut.) and *O. minutus* (L.), which consume about 22–35. These attack many species of insects and mites, including other predators, but feed mainly on *P. pilosus* in cultivated orchards in summer ; they also attack the winter eggs, and together with *Campylomma verbasci* (H.-S.), which is common on apple and feeds largely on *P. pilosus*, preferring the larger stages, they have two generations a year. *Conwentzia pineticola* End. has 2–3 generations a year, is abundant in hot summers and seems to be associated solely with outbreaks of *P. pilosus* ; both the adults and the larvae feed on the winter eggs after the leaves have fallen. *Oligota flavicornis* Erichson and *Stethorus punctillum* Weise, which are often numerous in orchards heavily infested by *P. pilosus*, feed exclusively on mites ; they prefer the active stages of *P. pilosus*, but attack the winter eggs in September if other food is scarce. *O. flavicornis* has one generation a year and a partial second, and *S. punctillum* two complete generations. The most important of the predacious mites are *Typhlodromus* (*Iphidulus*) *tiliae* Oudm. [*cf.* **38** 271], *T. finlandicus* (Oudm.) and *Phytoseius spoofi* (Oudm.), which are probably of more potential value in the control of *Paratetranychus* than the larger insect predators.

The second part contains notes on the life-histories and habits of the predators that are not abundant, including 12 species of Mirids.

SCHNEIDER (F.). **Über die Vergiftung der Bienen mit Dinitrokresol und das Autreten von Tänzen als Reaktion auf die Verteilung des Giftes im Stock.** [On the Poisoning of Bees by DNC and the Occurrence of Dancing as a Reaction to the Distribution of the Poison in the Hive.]—*Mitt. schweiz. ent. Ges.* **22** pt. 3 pp. 293–308, 2 figs., 8 refs. Berne, 1949.

In view of a report that a dormant spray of 2 per cent. DNC applied to fruit trees in Switzerland in warm, sunny weather in late March caused considerable mortality of honey bees, investigations were carried out, mainly in the laboratory, on the toxicity of DNC and its sodium salt to bees. The following is based on the author's summary of the results. Dried spray residues of DNC (sodium) were not toxic to bees, and sprays applied to the proboscis or tarsi were toxic only at abnormally high concentrations. Spray liquids were taken into the hive in the absence of water, but the latter was preferred when both were available. Both DNC and the salt acted rapidly as stomach poisons. In the presence of sugar and the saliva of bees, DNC was broken down into a colourless, presumably less toxic compound. Complete mortality was given by DNC and DNC (sodium) at 0·0013 and 0·0025–0·0031 mg. per bee, respectively, when ingested in 30 per cent. sugar solution by hungry bees. In a field test, DNC in sugar solution was taken into the hive in the same way as untreated sugar solution ; agitated dancing was the first symptom of poisoning, and flight from the hive was soon drastically reduced. In a poorly-fed colony, DNC in sugar solution was immediately distributed and taken up by other bees, complete mortality ensuing, but toxicity was much reduced in a hive with a good stock of honey. It is concluded that although DNC sprays are toxic to bees, they are not a serious danger since they are not normally applied to trees in flower. A supply of clean water near the hive is recommended as a precautionary measure.

VAN MARLE (G. S.). **Bladrollers in seringen.** [Leaf-rollers on Lilac.]—*Tijdschr. PlZiekt.* **58** pt. 5 pp. 191–196. Wageningen, 1952. (With a Summary in English.)

Lilac flowers exported by air from Holland to New York in 1950–51 were found on arrival to be infested by larvae of *Adoxophyes orana* (Fisch. v. Roesl.) (*Tortrix reticulana* Hb.) and were not admitted until they had been fumigated with methyl bromide at 18·5 fl. oz. (2 lb.) per 1,000 cu. ft. for two hours at 70°F. Investigations in Holland showed that infestation of lilac by this Tortricid, which is polyphagous and has been increasingly injurious to fruit trees in recent years, was very slight and of no economic importance, but the larvae were found to be common on privet [*Ligustrum*]. In experiments to develop a treatment to be applied to the flowers before export, methyl bromide gave complete mortality of larvae in half a day at 6 fl. oz. per 1,000 cu. ft. with an exposure of two hours at 25°C. [77°F.], and similar treatments were also effective against the pupae. No injury was caused to the flowers by fumigation with 40 fl. oz. for two hours at 17–21°C. [62·6–69·8°F.], and as a result of the work, fumigation with 20 fl. oz. for two hours at 21°C. is recommended. BHC as a smoke and DDT as a smoke and an atomised spray gave unsatisfactory control.

Guillaume (A.). **Les animaux ennemis de nos cultures—procédés de destruction.**—2nd revd. edn., [1+] 411 pp., 45 pls., refs., multigraph. Strasbourg, the Author, 1952. Price Fr. 3,300.

This reference book on the prevention and control of infestation of cultivated plants by animal pests is written with special reference to conditions in France and contains sections devoted to the organisation of plant protection there ; a systematic review of the vertebrate and invertebrate pests of plants ; general control methods, including summaries of the properties, formulations, uses, and advantages and disadvantages of the principal insecticidal compounds ; methods of applying insecticides ; French legislation concerning insecticides and their use ; and notices of recent publications in French dealing with pests and pest control. The section on pests, most of which are insects, contains descriptions and information on their bionomics, the damage caused by numerous species to vegetable crops, ornamental plants, fruit and forest trees, timber, stored products and fabrics, and specific control measures. The subject matter is based on the literature up to the end of 1950, and miscellaneous information published during 1951 is summarised in an appendix.

Papers noticed by Title only.

Shenefelt (R. D.). **Residual Effect of Chlordane on Crabgrass** [*Digitaria sanguinalis*] **when applied to Lawn for Control of Sod Webworm** [*Crambus* sp. in Wisconsin].—*J. econ. Ent.* **45** no. 5 p. 895, 1 ref. Menasha, Wis., 1952. [Reprint, see *R.A.E.*, A **40** 181.]

Wiesmann (R.). **Die Eintrittspforten des p,p′-Dichlordiphenyltrichloräthans am Insektenkörper.** [The Sites of Entry of p,p′DDT into the Body of an Insect.]—*Mitt. schweiz. ent. Ges.* **22** pt. 3 pp. 257–291, 18 figs., 34 refs. Berne, 1949. (With a Summary in French.) [For shorter account see *R.A.E.*, A **37** 115.]

Friederichs (K.). **Über karnivore Elateridenlarven und ihre Bedeutung im Pflanzenschutz.** [On carnivorous Elaterid Larvae and their Significance in Plant Protection (a review of the literature).]—*Z. angew. Ent.* **33** pt. 1–2 pp. 168–172, 21 refs. Berlin, 1951.

Butovitsch (V.). **Erhebungen über das Vorkommen und den Schaden der Holzschädlinge in Wohnhäusern in Südschweden.** [Investigations on the Occurrence of Timber Pests (mainly Coleoptera) in Dwelling Houses in southern Sweden and Damage by them.]—*Z. angew. Ent.* **33** pt. 1–2 pp. 172–186, 7 refs. Berlin, 1951. [For more detailed account see *R.A.E.*, A **40** 361.]

Bergold (G.). **Fortschritte und Probleme auf dem Gebiete der Insektenviren.** [Progress and Problems in the Field of Virus Diseases of Insects (a review of the literature).]—*Z. angew. Ent.* **33** pt. 1–2 pp. 267–278, 3 figs., 58 refs. Berlin, 1951.

Böttcher (F. K.). **Die Gefährdung der Bienen durch den Pflanzenschutz.** [Risks to Bees through Plant Protection (a review of the literature).]—*Z. angew. Ent.* **33** pt. 1–2 pp. 348–358, 56 refs. Berlin, 1951.

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Punjab Department of Agriculture (Lahore) : Reports for 1938–41.
Report of the Commission Appointed to Investigate the Moth Borer and Other Diseases. Barbados, 1894.
Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales (Bogotá) : Nos. 1–8 (1938–39).
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